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A REPORT OF WATER POLLUTION IN THE YELLOWSTONE DRAINAGE BASIN

Public Health Service
Kansas City Missouri

January 1952

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Water Pollution Series No. 23

PB 215 651

For Clean Water — "One River, One Plan"

YELLOWSTONE RIVER DRAINAGE BASIN

A COOPERATIVE STATE - FEDERAL REPORT ON WATER POLLUTION

JANUARY 1952

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A REPORT OF

WATER POLLUTION

IN THE

YELLOWSTONE DRAINAGE BASIN

Prepared by

MONTANA BOARD OF HEALTH
Division of Environmental Sanitation

NORTH DAKOTA DEPARTMENT OF HEALTH
Division of Environmental Sanitation Service

WYOMING DEPARTMENT OF PUBLIC HEALTH
Division of Environmental Sanitation

PUBLIC HEALTH SERVICE
Division of Water Pollution Control
Missouri Drainage Basin

Federal Security Agency
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INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters. Due regard must also be given to improvements necessary to conserve the waters for public water supplies, propagation of fish and aquatic life, recreational purposes, agricultural and other legitimate uses.

This report is produced under the cosponsorship of the Montana State Board of Health, North Dakota State Department of Health, Wyoming Department of Public Health, and the Public Health Service. It is based on data available as of January 1, 1952, on sources of pollution, treatment facilities employed, and stream conditions. The report also presents information concerning use of water resources, pollution entering water resources and resulting damages, benefits which may result from pollution prevention and abatement, pollution prevention measures in effect and those which appear to be needed.

Data and knowledge now available are sufficient to permit the immediate solution of most of the pollution problems within the Yellowstone River Basin without awaiting the results of additional surveys and studies.

A sincere effort has been made to present a fair picture of the water pollution problems in the Yellowstone Basin and to present reasonable conclusions and recommendations. It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive water pollution control program, will help in safeguarding the water resources.

ACKNOWLEDGMENTS

The cooperation of the State Water Pollution Control Agencies of Wyoming, Montana, and North Dakota in furnishing data for this report is acknowledged with appreciation.

Acknowledgment is also made to the Corps of Engineers, U. S. Army, Department of Defense; Bureau of Reclamation, Fish and Wildlife Service, and Geological Survey, Department of Interior; the Weather Bureau, and Bureau of Census, Department of Commerce, whose published reports furnished much of the information contained herein on the history, hydrology, stream discharges, population trends, and economic development of the Yellowstone Basin.

Thanks is also tendered to the reviewing agencies, whose comments have materially aided the preparation of the report. These include the Corps of Engineers, Missouri River Division, Omaha, Nebraska; Bureau

of Reclamation, Region 6, Billings, Montana; National Park Service, Omaha, Nebraska; Fish and Wildlife Service, Billings, Montana; Federal Power Commission, Chicago, Illinois; Department of Agriculture, Lincoln, Nebraska; Department of Commerce, Denver, Colorado; and the Division of Water Pollution Control, Public Health Service, Washington, D. C.

SUMMARY

The Yellowstone River is one of the principal tributaries of the Missouri River. It drains an area of about 70,400 square miles located in northern Wyoming, southeastern Montana, and western North Dakota. The main stem of the Yellowstone and two of its major tributaries have their headwaters in Yellowstone National Park. Two otner tributaries rise along the eastern flank of the Rocky Mountains.

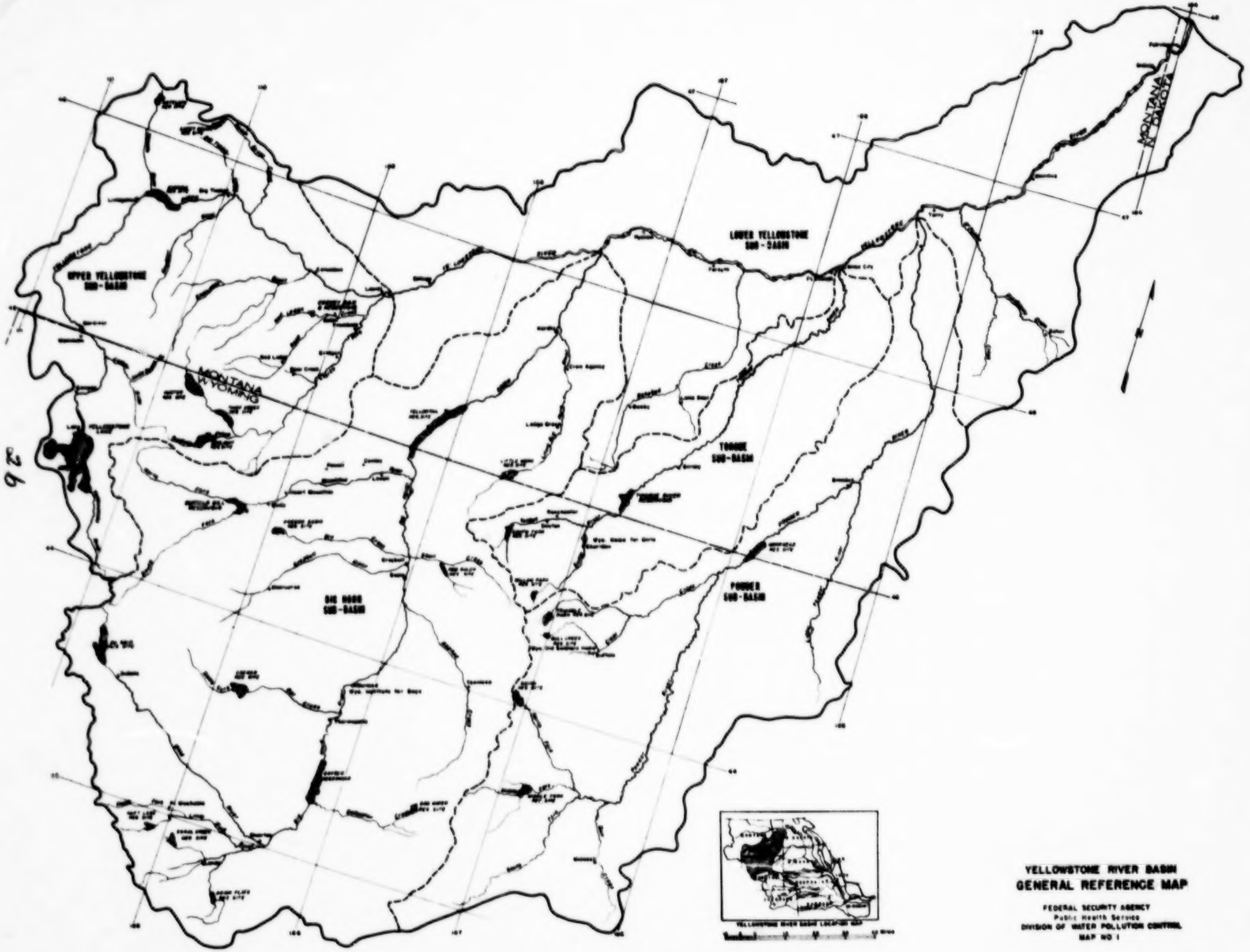
The drainage area of the Yellowstone is rich in natural resources. Its soils are fertile and only the addition of water is needed to produce abundant crops of wheat, beans, legumes, and sugar beets. Vast oil fields underlie the area producing large amounts of crude oil for the petroleum industry. Quantities of coal, gypsum, bentonite, sulfur, phosphate, gold, chromite, copper, tungsten, silver, iron, zinc, lead, and molybdenum are mined annually. The Yellowstone's waters have great potentiality for hydroelectric power.

The population of the Basin is relatively sparse and communities are small and widely separated. Billings, Montana, is the largest city with a population of 31,724 in 1950. Most of the cities are located on or near the watercourses and use the streams extensively for water supply and sewage disposal. Sport fishing is a thriving and valuable use of water in the headwaters of the Yellowstone and its several tributaries. The swift currents and cold temperature of the water are not conducive to bathing.

Industrial wastes containing oil, phenolic compounds, cyanide, rock flour, and other substances have taken a heavy toll of fishery values. Toxic materials have caused more damage to fish life than have organic wastes. Significant depletion of oxygen has never been reported in any of the streams in the Basin. There is evidence, however, to indicate that some public water supplies have been adversely affected by pollution. The use of polluted waters for the irrigation of food crops is a matter of considerable concern to health authorities.

The Yellowstone and several of its tributaries are interstate streams. Interstate pollution has not been encountered except in the Big Horn River. This has been in the nature of excessive taste and odors in public water supplies taken from the Big Horn River by Wyoming and Montana cities. The cause of the tastes and odors has not been definitely established, however it is allegedly produced by industrial wastes discharged to the streams in the Wyoming section of the Basin.

The Yellowstone River and its tributaries play an important part in the Missouri River development program, as twenty-four reservoirs have been proposed for construction in the Basin. Completion of these



YELLOWSTONE RIVER BASIN
GENERAL REFERENCE MAP

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 1

projects may have a marked effect not only on municipal water supplies within the Basin but also on such supplies taken from the main stem of the Missouri River below the mouth of the Yellowstone. It has been estimated that 23 percent of the silt in the Missouri River at Kansas City is contributed by the Yellowstone system. Much of this silt will be retained in reservoirs to be constructed on the Yellowstone, Big Horn, and Missouri Rivers.

The effect of the regulation of streams on sewage and industrial waste disposal needs has not yet been ascertained. Additional information concerning reservoir releases will be needed before an evaluation can be made. The removal of settleable materials from both domestic sewage and industrial waste is recommended by pollution control agencies of the Basin as a minimum requirement for controlling pollution. There are no known sources of pollution within the North Dakota section of the Yellowstone Basin.

The State water pollution control agencies concerned have been restricted in their operation by insufficient funds and personnel, and inadequate legislative backing. In 1951, however, pollution control legislation of the State of Wyoming was considerably strengthened and broadened and is apparently adequate for controlling pollution deleteriously affecting any legitimate water use.

The antipollution legislation of the State of Montana is only enforceable when pollution affects public water supplies or endangers the public health. A resumé of the State laws governing the control of stream pollution may be found in appendix A.

Data on waste treatment in the Basin indicate that 30 of the 48 municipalities* provide some degree of treatment for their sewage wastes. Approximately 74,000 of the 125,500 sewered population are served by sewage treatment facilities. Eighteen municipalities, in which about 52,000 people reside, are discharging untreated wastes into the streams. About 73 percent of the municipal sewage treatment works now in operation are considered adequate. In addition to the wastes from the municipal sewer systems, 23 industrial plants having private waste outlets contribute more than one million population equivalents of organic pollution. Fifteen of the 23 industries have provided some degree of treatment. Five, or 33 percent, of the existing industrial waste treatment plants are considered to be capable of producing a satisfactory effluent. The industries without treatment facilities produce by far the greatest quantity of pollutional material. Untreated wastes or wastes subjected to very minor treatment are contributed by five sugar refineries, one packing plant, and three canneries. Sugar refineries constitute the major source of organic pollution and contribute a great amount of waste to the streams during their fall and early winter seasonal operations. Other untreated wastes, principally waste oil and solvents, originate from railroad maintenance shops.

*Includes incorporated or unincorporated municipalities, other legal bodies, significant institutions, resorts, recreational centers, or other population centers.

Approximately 20 percent of the organic pollution originating in municipal sewage systems is removed by treatment prior to its discharge into the waterways. The removal of pollution from industrial wastes has not been determined, but percentagewise it is obviously much less than for municipal sewage.

Construction of waste treatment works has been sporadic in the years 1946 through 1949. No municipal sewage treatment works were constructed, however four industrial waste recovery plants were installed. In 1950 and 1951 four sewage treatment plants serving more than 40,000 people were completed, one more was under construction, and plans were drawn for three additional municipal plants. The cost of constructing abatement facilities at municipal and industrial sources of pollution is conservatively estimated at $5,000,000. Table 1 lists the projects needed to adequately control pollution in the Yellowstone River Basin.

Table 1. Yellowstone River Basin - Municipalities and industries requiring improvements for the abatement of pollution

Name and location	Population served	Improvements needed **
Montana		
Baker	1,600	Replacement (Secondary)
Big Timber	1,280	Enlargement (Secondary)
Billings	30,000	Additional treatment (Chlorination)
Great Western Sugar Co. Refinery	400,000*	New plant or other control measures
Pierce Packing Co.		New plant or other control measures
Midland Packing Co. (Cannery)		New plant or other control measures
Broadus	500	New plant (Primary)
Crow Indian Agency Headquarters	800	Replacement (Secondary)
Forsyth	2,000	Enlargement (Primary)
Fort Keough	75	New plant (Secondary)
Gardiner	850	Enlargement (Secondary)
Glendive	5,060	New plant (Primary)
Northern Pacific Railroad		New plant or other control measures
Hardin		
Holly Sugar Co. Refinery	200,000*	New plant or other control measures
Hysham	275	Enlargement (Primary)
Livingston	6,700	New plant (Secondary)
Northern Pacific R.R. Maintenance Shops		New plant or other control measures
Lodge Grass	840	New plant (Secondary)
Miles City	7,200	New plant (Primary)
C.M.St.P. & Pac. R.R. Shops		New plant or other control measures
Laurel		
Co-op Oil Refinery		Additional control measures needed
Northern Pacific Railroad Shop		Additional control measures needed
Sidney	3,000	New plant (Primary)
Holly Sugar Co. Refinery	200,000*	New plant or other control measures
Jardine		
Jardine Mining Co.		Additional control measures
Red Lodge		
Red Lodge Cannery		Additional control measures needed
Wyoming		
Basin	1,500	New plant (Primary)
Buffalo	3,000	Enlargement (Secondary)
Cody	3,800	New plant (Secondary)
Husky Oil Refining Co.		New plant or other control measures
Cowley	4,100*	New plant or other control measures (Secondary)
Cowley Canning Co.		New plant (Primary)
Greybull	1,900	New plant (Primary)
Lander	4,000	New plant (Primary)
Lovell	3,000	New plant or other control measures
Great Western Sugar Co. Refinery	200,000*	New plant (Primary)
Powell	1,200	New plant (Primary)
Riverton	4,500	New plant (Primary)
Thermopolis	4,000	Enlargement
Empire State Oil Refinery		New plant (Secondary)
Hot Springs State Park	250	New plant (Primary)
Worland	4,000	New plant or other control measures
Holly Sugar Refinery	200,000*	Additional control measures
Pure Oil Co. Refinery		Enlargement (Secondary)
Sheridan	15,000	New plant (Secondary) under construction
Wyoming State Home for Girls	75	

*Figures cited are organic population equivalents of industrial waste.

**Degree of treatment recommended by the appropriate State water pollution control agency.

CONCLUSIONS

1. The Water Pollution Control Agencies of Montana, North Dakota, and Wyoming have worked closely with Federal and other State agencies interested in the Missouri River Basin Development Program. Recognition of all uses of water is essential to proper planning of pollution abatement programs.

2. Taste and odor problems arising in public water supplies indicate that pollution now entering the streams is objectionable. The intensity of the pollution is such that it is not assimilated by the natural purification processes in action during the time it travels the long distances between the sewer outlets and the water intakes.

3. The resort and tourist industry ranks third in value in Montana, and is equally valuable in Wyoming. Among attractions afforded tourists in these States is the beauty of the streams and lakes of the Yellowstone Basin. Pollution of these waters must be kept at a minimum for aesthetic reasons. These waters also support a heavy fishery which could be readily destroyed by pollution.

4. State legislation which will promote water pollution control in industry and municipalities is needed in Montana. Such legislation should allow the water pollution control agency to control effects of pollution on all legitimate uses of water rather than restrict the agency's activities to public health aspects of pollution.

5. Approximately 52,000 people, or about 41 percent of the population served by sewer systems, contribute untreated sewage to the streams of the Yellowstone Basin. During the period when industries are in peak production the untreated organic waste discharged is about 20 times as great as domestic sewage.

6. The great reserve of natural resources in the Yellowstone Basin indicates that an expanded economy is probable, principally in the petroleum and food processing fields. A natural sequence to such an expansion would be an increase in both domestic and industrial wastes.

RECOMMENDATIONS

It is recommended that:

1. Water pollution control legislation embodying all phases of water use be adopted by the States of Montana and North Dakota.

2. Sufficient funds and personnel be provided the State water pollution control agencies to prepare and carry out a comprehensive program of pollution abatement.

3. Municipalities and institutions now discharging untreated sewage

provide treatment facilities as recommended by the State water pollution control agency having jurisdiction. These include: Livingston, Lodge Grass, Fort Keough, Miles City, Broadus, Glendive, and Sidney, Montana; Lander, Riverton, Thermopolis, Worland, Basin, Cody, Greybull, Powell, Hot Springs State Park, Wyoming Home for Girls, and Lovell, Wyoming. The sewage treatment works at Gardiner, Billings, Hysham, Forsyth, Big Timber, Baker, and Crow Indian Headquarters, in Montana; and Sheridan and Buffalo, Wyoming, be enlarged, replaced, or otherwise remodeled to provide adequate treatment of sewage.

4. All toxic material, taste and odor producing waste, and settleable solids from industrial operations be prevented from entering the streams of the Yellowstone Basin. Industrial waste treatment as specified by the State water pollution control agencies should be provided.

GENERAL DESCRIPTION

Historical Background

The Yellowstone River obtains its name from the English translation of the French rendition of the Indian name for this stream. Indians called the river "mi tsi a da zi," meaning Rock Yellow River. In French this became "Roche Jaune" and "Pierre Jaune," and in English "Yellow Rock," "Yellow Stone," and finally "Yellowstone." The name apparently comes from the coloring of the rock found in Yellowstone Canyon in Yellowstone Park. According to some historians the river was also known as "Elk River" by the Indians.

Francis Antoine Larocque is historically recorded as having been the first white man to see the Yellowstone River. He is reported to have come upstream as far as Pompey's Pillar in 1805. Captain Clark of the Lewis and Clark Expedition followed the river downstream from about the present site of Livingston, Montana, in 1806. The first trading post, known as Fort Raymond, was established by Manuel Lisa at the mouth of the Big Horn River in 1807, but due to trouble with Indians this fort was abandoned in 1811. There was little development in this area until 1822, when the Rocky Mountain Fur Company was established. In 1829 John Jacob Astor's American Fur Company headed by Kenneth Mckenzie, built Fort Union near the junction of the Yellowstone and Missouri Rivers. The fort burned in 1831 and was rebuilt during the same year. It was finally razed in 1868.

The first steamboat arrived at the mouth of the Yellowstone in 1832, and the Northern Pacific Railroad reached Glendive, Montana, in July 1881. Agriculture in the Basin began with the establishment of the great cattle ranches about 1870. Cattle were trailed northward from Texas to Wyoming and Montana during the period between 1870 and 1890. The great cattle ranches were followed by sheepmen and homesteaders who began to crowd out the cattlemen. Dry land farmers settled large areas of the Basin, but because of drought were forced to abandon much of their holdings in the 1920s. Since that time a portion of the abandoned land has been restored to grazing. Irrigation began in the Yellowstone Basin in the 1860s, and

increased as settlement progressed; more than one million acres of land are now under irrigation.

The Powder River was first named the "Red Stone" by Captain Clark in 1806, from a translation of the Indian name "Wa-la-sah." Before Captain Clark's report of his trip was released local trappers and hunters bestowed the name of "Powder River" due to the presence of small particles of coal resembling gunpowder along the stream.

The Big Horn apparently gets its name from the native bighorn sheep. The Big Horn River was first seen in 1743 by Chevalier de la Verendrye, who was seeking a river route to the Pacific Ocean. White men, in search of furs and gold, next saw the region in 1804. Except for these early visitors there were very few white people in the area until the opening of the Bozeman Trail in 1864. Miners and settlers traveled the Bozeman Trail on their way to the northwest, which was a short cut between the North Platte River in Wyoming and the three forks of the Missouri River in Montana. Although the first peace treaty with the Indians was signed in 1851 on Horse Creek, the Indian wars continued until the government took effective action against the Indians after Custer's defeat at the Battle of the Little Big Horn in 1876. Fort Custer was established at the junction of the Big Horn and Little Big Horn Rivers in 1877.

The Tongue River receives its name from a translation of the Indian word "Lazeka," meaning "tongue." There is a legend which says the stream was so named for a tongue-shaped mountain near its head, but verification of this is lacking, as no mountain of this shape has been located.

Physical Description

The Yellowstone River Basin is located in north central Wyoming, southeastern Montana, and includes a small portion of western North Dakota. It is bounded by the Rocky Mountains on the west, the Missouri and Musselshell Basins on the north, the Little Missouri and Cheyenne Basins on the east, and by the Platte Basin on the south. The Basin is pear-shaped, having a length of about 440 miles and a maximum width of about 320 miles, the major dimension extending northeasterly and southwesterly. It has a total drainage area of 70,400 square miles, of which 35,925 square miles are in Montana, 33,735 square miles in Wyoming, and 740 square miles in North Dakota. (See map No. 1).

The Yellowstone Basin is divided into five principal subdivisions as follows: the Upper Yellowstone, Lower Yellowstone, Big Horn, Tongue, and Powder Sub-Basins. The Upper and Lower Yellowstone Sub-Basins contain the main stem of the Yellowstone River and the smaller tributaries. Several of the small tributaries are important, but will not be discussed separately since conditions are similar.

The elevations in the Basin vary considerably from a maximum of 13,785 feet at Gannet Peak in the Wind River Range to an elevation of 1,845 feet at the mouth of the Yellowstone River. Nearly half of the area lies below the elevation of 4,000 feet, with the remainder varying from about 5,000 feet in the high plains areas to over 13,000 feet in the mountains.

The Yellowstone River leaves Yellowstone National Park at Gardiner, Montana, then flows through a steep winding gorge for about 21 miles and leaves the mountains near Livingston, Montana. From Livingston to Columbus it winds through a fertile valley having a width of approximately one mile, bordered by sandstone bluffs. Below Columbus the river flows a distance of approximately 400 river miles through a wide valley to its confluence with the Missouri at Buford, North Dakota. The river has a total length of approximately 671 river miles with an average stream slope of 32.45 feet per mile upstream and 7.21 feet per mile downstream from Livingston.

The topography of the Yellowstone Basin is characterized by the rugged foothills and mountain ranges of the Rocky Mountains. The eastern and northerly portions of the Basin extend into the Missouri plateau section of the Great Plains. In this area occasional flattopped mesas and isolated buttes may rise 500 feet or more above the surrounding plains. Numerous glacial lakes are found throughout the mountains. Glacial cirques, or U-shaped valleys, are found in the Big Horn range.

The extreme variation in elevations encountered in this Basin affects wide climatic differences. The eastern section is influenced by the inland continental conditions characteristic of the northern Great Plains, while the mountain area is more affected by winds from the Pacific coast. The annual mean temperatures vary from 46.8° at Bridger, Montana, to 32° in Yellowstone Park. In the plains region a maximum temperature of 117° was recorded at Glendive, Montana, and a minimum of -65° at Miles City. In the mountain region the temperatures vary from a maximum of 105° at Cody, Wyoming, to -51° at Lake in Yellowstone Park. The growing season varies from 130 days in the plains to as little as 40 days in Yellowstone Park, with an average growing season in the cultivated areas of about 120 days. Very cold weather may be experienced in winter. The very severe winter weather is frequently modified by the Chinook winds which bring warm air from the Pacific Ocean. Table 2 summarizes weather data at various points in the Basin.

There are at present only a few controls on the main channel of the Yellowstone River, however authority has been granted by Congress to construct a dam at Mission, Montana, a short distance downstream from Livingston. Yellowtail Dam upstream from Hardin, Montana, on the Big Horn River has been authorized and Boysen Dam has been constructed between Riverton and Thermopolis, Wyoming, on the Big Horn River. The Montana State Water Conservation Board has constructed a dam on the Tongue River, one on Red Rock Creek, and another on Red Lodge Creek. In addition to those mentioned there are a number of small reservoirs furnishing water for irrigation projects on tributaries of the Yellowstone, principally in Wyoming. The Missouri River development program proposes to construct an additional 24 reservoirs in the Yellowstone Basin.

It is to be anticipated that the new storage reservoirs will assist in regulating low stream discharges. The minimum mean monthly unregulated flow anticipated in both winter and summer once in five years and once in ten years is included in table 3. Most of the low flows occur during the winter months with concurrent ice cover.

The Big Horn, the largest tributary of the Yellowstone, has its origin at the junction of the Popo Agie and Wind Rivers near Riverton, Wyoming. These rivers rise in the Wind River Range and Absaroka Mountains. The Basin is divided topographically into three segments, known in downstream order as the Wind River and Big Horn Basins in Wyoming, and the Lower Big Horn Basin in Montana. The upper portion of the stream traverses a high plateau between the Continental Divide and the Big Horn Mountains. Basin floors are broad, rolling plains cut by numerous eroded valleys and stream courses. The main stem is 461 miles in length and the stream slope averages 6.5 feet per mile. The Basin has a total drainage area of 22,942 square miles, with approximately 18,800 square miles in Wyoming and 4,140 square miles in Montana.

The Tongue River has its source on the northeastern portion of the Big Horn Mountains in Wyoming. The river has a total length of 265 miles, and drains an area of 5,325 square miles. The average slope from the headwaters to Ranchester, Wyoming, is 195.06 feet per mile. The slope from Ranchester to the mouth, a distance of 211 miles, is 6.7 feet per mile. The river drains an area of plains and badlands, flowing through a valley having a width of 1 to 2 miles, except for approximately 20 miles of narrow valley near the Wyoming-Montana border. The stream flows into the Yellowstone River at the western edge of Miles City, Montana. The Tongue River flow varies from the high spring floods and the intermittent flash floods during the summertime to a very low flow during the autumn months.

The Powder River rises in the Big Horn and Rattlesnake Mountains in central Wyoming. The main channel is formed near Kaycee, Wyoming, where the South Fork, Middle Fork, and North Fork converge, and has a length of approximately 405 miles. The Powder River drains an area of 13,415 square miles, and has an average slope of 9.3 feet per mile from the junction of the North and Middle Fork to the mouth, a distance of 381 miles. The river flows through badlands, where it gathers considerable silt. There are many sand bars and mud flats in the river, and the channel is relatively shallow, wide, and unstable. It has been aptly described as a river "a mile wide, a foot deep, too thin to plow, and too thick to drink." The stream flow is ordinarily high in the spring but decreases until it may be practically dry in the autumn.

Table 2. Yellowstone River Basin - Weather data*

	Livingston	Red Lodge	Billings	Bridger	Glendive	Riverton	Cody	Sheridan
Number of years of record	47	50	53	38	55	33	44	54
Low mean monthly temperature degrees	-7.0	-9.7	11.9	-6.9	-22.7	-3.0	5.0	1.8
High mean monthly temperature degrees	92.9	84.7	96.3	96.7	102.2	73.3	76.3	77.9
Mean annual temperature degrees	45.9	40.4	46.7	46.8	44.3	42.8	45.2	43.9
Minimum temperature degrees	-45	-38	-49	-35	-50	-46	-46	-41
Maximum temperature degrees	106	101	112	110	117	103	105	106
Average annual ppt inches	14.38	18.90	14.38	10.94	14.45	9.81	9.42	15.37
Average May-Sept. ppt inches	8.55	10.56	8.64	6.55	9.74	5.68	5.75	8.17
Average snowfall, inches	49.4	107.5	41.0	35.6	34.7	37.7	35.0	55.1
Average number of days between killing frosts	129	104	133	119	136	128	128	133

*Basic data from Weather Bureau reports

Table 3. Yellowstone River Basin - Probability of minimum mean monthly stream flows-cubic feet per second-

Location	Minimum summer flows** occurring once in 5 years	10 years	Minimum winter flows occurring once in 5 years	10 years
Yellowstone River at Corwin Springs	973	930	642	549
Yellowstone River near Billings, Montana	2,274	1,812	1,587	1,457
Yellowstone River near Miles City, Montana	3,693	2,708	2,487	2,166
Yellowstone River near Sidney, Montana	3,280	2,731	2,394	2,1[illegible]
Clarks Fork at Chance, Montana	178	154	133	126
Clarks Fork at Edgar, Montana	306	233	285	240
Rock Creek near Red Lodge, Montana	32	26	24	23
North Fork Popo Agie near Lander, Wyoming	12	7	10	7
Wind River at Riverton, Wyoming	273	256	189	159
Big Horn River at Kane, Wyoming	459	370	660	574
Big Horn River near St. Xavier, Montana	1,350	1,308	1,124	908
Owl Creek near Lucerne, Wyoming	0.5	0.0	1.0	0.0
Greybull River at Meeteetse, Wyoming	121	93	51	44
Greybull River near Basin, Wyoming	2	1	23	14
Shoshone River below Buffalo Bill Reservoir	228	227	198	144
Shoshone River at Byron, Wyoming	242	181	216	145
Little Big Horn River near Crow Agency, Montana	46	24	97	83
Tongue River near Acme, Wyoming	40	10	80	65
Goose Creek near Sheridan, Wyoming	14	11	5	4
Powder River near Arvada, Wyoming	3	1	29	11
Powder River at Moorhead, Montana	29	19	72	30
Powder River near Locate, Montana	35	5	40	20

*Differences from upstream gaging stations due to diversion and regulation.

**Table was compiled from data included in U. S. Geological Survey Reports.

Economic Development

The economic history of the Yellowstone Basin began in 1807 with the establishment of a trading post known as Fort Raymond at the mouth of the Big Horn River. The fur trade with the Indians attracted the first capital investment in the resources of the Basin, and for 60 years it remained the principal occupation of whites who inhabited the region. The turn to agriculture as a principal means of livelihood began about 1870 with the formation of the great cattle ranches. Grazing was replaced by dry land farming, which is gradually being superseded by a return to livestock raising due to the uncertainty of a harvest in this semiarid region. Since 1920 an industrial exploitation of the rich oil fields and mines of the Basin has taken place, with the result that industry rivals agriculture in net value, and supports a large portion of the Basin's population. The rural population has steadily declined during the past three decades while the urban population has steadily gained. The density of population is estimated at 3.6 persons per square mile.

The Basin is a highly favored recreational area. Over a million tourists a year visit Yellowstone National Park and other scenic places. The tourist trade is the third most valuable of all forms of business in Montana, and enjoys a similar position in Wyoming. All indications are that the tourist trade will soon become the leading source of income for the region.

A number of thriving cities have grown up, the largest of which is Billings, Montana, population 31,724 in 1950. The cities of Forsyth, Glendive, Miles City, Laurel, and Livingston, Montana, are important marketing and rail centers. Cody, Lovell, Thermopolis, and Worland, Wyoming, and Billings and Laurel, Montana, have become centers of the oil refining industry.

Excellent highways connect the cities of the Basin. The Northern Pacific, Great Northern, Chicago, Milwaukee, St. Paul and Pacific, and Chicago, Burlington and Quincy railroads traverse the region. The thriving tourist, industrial, and agricultural trade have emphasized the need for good transportation systems. Navigation of the streams has not been considered economically feasible.

The hydroelectric power potential of the Basin has been estimated at two million kilowatts. The construction of high head dams and the installation of power generating equipment will greatly increase electrical power facilities. Cheap and ample power may be important factors in the development of many new industries in the area. In addition to the hydroelectric power potential, vast coal and lignite deposits remain to be developed either as acceptable solid fuels or as synthetic liquid fuels.

The phosphate deposits of west central Wyoming may well become a principal source of fertilizer for the entire midwestern agricultural region. Much of the mountainous section of the Basin, roughly one-third of the total area, is forested and contains valuable stands of coniferous timber. The production of lumber is a well established industry and is

progressively becoming more valuable. No pulp or paper industry has yet been established, however possibilities appear favorable for future development.

It is reasonable to believe that increased irrigation, now planned as a part of the Missouri Basin Development Program, will result in a stabilization of agriculture in the Basin, which in turn should reflect a general population increase in both the rural and urban areas. If such increases occur, the problems of pollution will also increase. At the present time the population of the Basin totals about 250,000 people, 42 percent of whom reside in Wyoming, 54 percent in Montana, and 4 percent in North Dakota. Less than half this population live in incorporated towns or cities. The occupational classifications of employed persons is given in table 4.

Factors which have tended to retard the economic development of this naturally rich area include the lack of a local consumptive market. The long distances finished or raw products originating in the Basin must travel to major markets of the nation bring their cost to a level where they have been unable to compete successfully with products from more favored locations. Conditions, however, are becoming more favorable as the population of the nation increases and moves westward.

Table 4. Yellowstone River Basin - Economic importance - Comparison of basin area with entire state

	Wyoming			Montana			North Dakota		
	Entire State	Counties in Basin	Percent	Entire State	Counties in Basin	Percent	Entire State	Counties in Basin	Percent
Area, square miles	97,914	33,735	34.45	147,138	35,925	24.41	70,665	740	1.04
Population	288,000	104,588	41.71	559,456	134,238	23.99	641,935	11,924	1.85
Employed total	86,559	34,170	39.47	185,564	43,660	23.52	200,396	3,791	1.88
Employed in agriculture	25,440	12,870	50.58	59,083	17,445	29.53	106,962	2,714	2.53
Employed in mining	6,282	1,484	23.62	13,526	674	4.98	987	6	0.61
Employed in construction	4,144	2,070	49.95	8,838	2,152	24.34	4,083	45	1.10
Employed in manufacturing	4,601	2,316	50.33	13,747	1,810	13.16	5,002	29	0.5
Employed in transportation, communications and utilities	8,995	2,172	24.14	14,883	4,194	28.18	10,158	65	0.63
Employed in wholesale and retail trade	12,341	5,367	43.48	29,315	7,247	24.72	27,468	335	1.21
Employed in business and personal services, excluding domestic services	13,921	5,896	42.35	29,890	6,828	23.00	28,888	388	1.34
Number of mfg. establishments	310	133	42.90	585	126	21.54	350	5	1.42
Number of retail stores	4,113	1,799	43.73	8,481	1,900	21.49	8,449	153	1.7
Bank deposits - 1944	130,084	54,087	41.57	305,669	73,980	24.20	283,701	3,781	1.33
Rural level of living index	117	118		113	110		108	110	

Table 5. Yellowstone River Basin - Population of cities

City	State	Population U. S. Census			
		1920	1930	1940	1950
Upper Yellowstone River Sub-Basin					
Bear Creek	Montana	744	472	324	162
Big Timber	Montana	1,282	1,224	1,533	1,677
Bridger	Montana	679	567	783	854
Clyde Park	Montana	352	302	216	280
Columbus	Montana	987	834	962	1,090
Fromberg	Montana	520	446	533	442
Gardiner	Montana	-	-	602	-
Joliet	Montana	440	399	476	410
Laurel	Montana	2,239	2,558	2,744	3,647
Livingston	Montana	6,311	6,391	6,642	7,667
Red Lodge	Montana	4,515	3,026	2,990	2,715
Lower Yellowstone River Sub-Basin					
Baker	Montana	1,067	1,212	1,304	1,759
Billings	Montana	15,100	16,380	23,261	31,724
Fairview	Montana	513	576	901	942
Forsyth	Montana	1,838	1,591	1,696	1,884
Glendive	Montana	3,816	4,629	4,524	5,235
Hysham	Montana	360	258	392	410
Ismay	Montana	344	277	176	182
Miles City	Montana	7,937	7,175	7,313	9,180
Plevna	Montana	241	258	291	247
Sidney	Montana	1,400	2,010	2,978	3,975
Terry	Montana	1,139	1,372	1,012	1,179
Alexander	North Dakota	-	386	415	-
Rawson	North Dakota	-	65	72	-
Big Horn River Sub-Basin					
Basin	Wyoming	1,088	903	1,099	1,220
Byron	Wyoming	326	240	388	350
Cody	Wyoming	1,242	1,830	2,536	3,866
Cowley	Wyoming	687	525	491	463
Deaver	Wyoming	142	85	111	118
Dubois	Wyoming	243	177	412	279
Greybull	Wyoming	2,692	1,806	1,828	2,262
Hudson	Wyoming	977	328	330	293
Kirby	Wyoming	174	173	107	99
Lander	Wyoming	2,133	1,826	2,594	3,319
Lost Cabin	Wyoming	49	34	34	73
Lovell	Wyoming	1,686	1,857	2,175	2,508
Manderson	Wyoming	-	96	130	107
Meeteetse	Wyoming	300	296	373	404
Pavillion	Wyoming	-	-	176	241
Powell	Wyoming	2,463	1,156	1,948	3,809
Riverton	Wyoming	2,023	1,608	2,440	4,126
Shoshone	Wyoming	561	263	226	891
Tensleep	Wyoming	-	-	345	289
Thermopolis	Wyoming	2,095	2,129	2,422	2,834
Worland	Wyoming	1,225	1,461	2,710	4,206
Hardin	Montana	1,312	1,169	1,886	3,264
Lodge Grass	Montana	-	373	839	536
Tongue River Sub-Basin					
Dayton	Wyoming	136	348	240	316
Ranchester	Wyoming	147	155	189	251
Sheridan	Wyoming	9,175	8,536	10,529	11,402
Powder River Sub-Basin					
Buffalo	Wyoming	1,772	1,749	2,302	2,665
Clearmont	Wyoming	-	214	215	225
Edgerton	Wyoming	-	269	232	203
Kaycee	Wyoming	217	161	210	211
Midwest	Wyoming	-	-	806	-
Broadus	Montana	-	-	571	517

USES OF WATER RESOURCES

The high mineral content of much of the ground waters of the Yellowstone Basin has made their general use undesirable, therefore surface waters are the principal sources of domestic water supplies for the area. Most recent data indicate that approximately 82 percent of the urban population are provided water derived from streams and lakes, the remainder obtaining water from ground sources. Surface water, primarily from irrigation ditches, is used by many farm and ranch residents in preference to the highly mineralized ground waters. The individual supplies are usually conditioned by filtration and chlorination before use. It is estimated that about 28 million gallons of water is consumed daily by the domestic population and by industries connected to municipal water systems. The quantity of water taken directly from streams by industry greatly exceeds that supplied through municipal systems. Heavy users of industrial water include mines, metal mills, sugar refineries, oil refineries, canneries, slaughterhouses, and rendering plants. The amount of water used by industry in the Yellowstone Basin is estimated at 70 million gallons per day during periods of peak demand. The oil refineries and sugar refineries constitute the major users of water. Map No. 6 indicates the location of major industrial water consumers.

Irrigation has been practiced in this Basin since the 1860s. The Bureau of Reclamation and the States are constructing or have constructed vast irrigation systems. The irrigated lands support a large portion of the population and produce many valuable crops, including hay, dry beans, corn, and sugar beets, all of which grow well throughout the area.

Game fishing is very popular in the upper reaches of the river and its tributaries. Only limited fishing exists in the lower portions of the stream where the water is more turbid and the flow is less rapid. Much of the area, however, because of game fishing and other natural attractions, has become a veritable tourists' paradise. There is considerable wildlife in the area, principally antelope, deer, elk, moose, and beaver. There are also some bear and mountain lion. Chinese pheasants and other upland birds are found throughout the region.

The potential hydroelectric power in the Yellowstone Basin has been estimated to be about two million kilowatts. Seven hydroelectric plants are now operating to furnish power for the domestic and industrial consumers of the Basin. Most of the hydroelectric plants are located in the headwaters.

The watering of livestock is also a valuable use of water. Cattle and sheep are raised in large numbers and great dependence is placed on the streams as a source of water for them. The streams have been and must continue to be used extensively for the removal and ultimate disposal of municipal and industrial wastes.

The important uses of water make it necessary that the streams be maintained relatively free of pollution. Public and industrial water consumers and the tourist industry are dependent upon high quality surface waters. Table 6 indicates in tabular form municipalities and their source of public water supply.

Table 6. Yellowstone River Basin - Municipal water supplies

6-A - Ground Water Sources

Sub-Basin	Municipality	State	Source	Treatment		Estimated population served
Upper Yellowstone River						
	Big Timber	Montana	Infiltration Gallery	Chlorination		1,910
	Bridger	Montana	Deep wells	None		800
	Clyde Park	Montana	Springs	None		200
	Gardiner	Montana	Springs	Chlorination		200
	Joliet	Montana	Well	None		500
					Total	3,500
Lower Yellowstone River						
	Baker	Montana	Wells	None		1,400
	Fairview	Montana	Well	None		450
	Lyndon	Montana	Wells	None		400
	Miles C[illegible] / Days' School	Montana	Wells	Chlorination		160
	Sidney	Montana	Wells	None		1,300
	Alexander	No. Dakota	Well	None		100
					Total	3,810
Big Horn River						
	Greybull	Wyoming	Infiltration Gallery	Chlorination		1,500
	Hudson	Wyoming	Shallow well	None		330
	Kirby	Wyoming	Well	Chlorination		750
	Lander	Wyoming	Infiltration Gallery	Chlorination		2,000
	Pavillion	Wyoming	Well	None		50
	Powell	Wyoming	Infiltration Gallery-well	Chlorination		2,000
	Riverton	Wyoming	Deep well	None		2,500
	Shoshoni	Wyoming	Deep well	None		[illegible]
					Total	[illegible]
Tongue River						
	Birney	Montana	2 Drilled wells	None		50
					Total	50
Powder River						
	Clearmont	Wyoming	Well	None		175
	Midwest[2]	Wyoming	Offset well	CFD		2,000
	Broadus	Montana	Artesian well	None		500
					Total	2,675

6-B - Surface Water Supplies

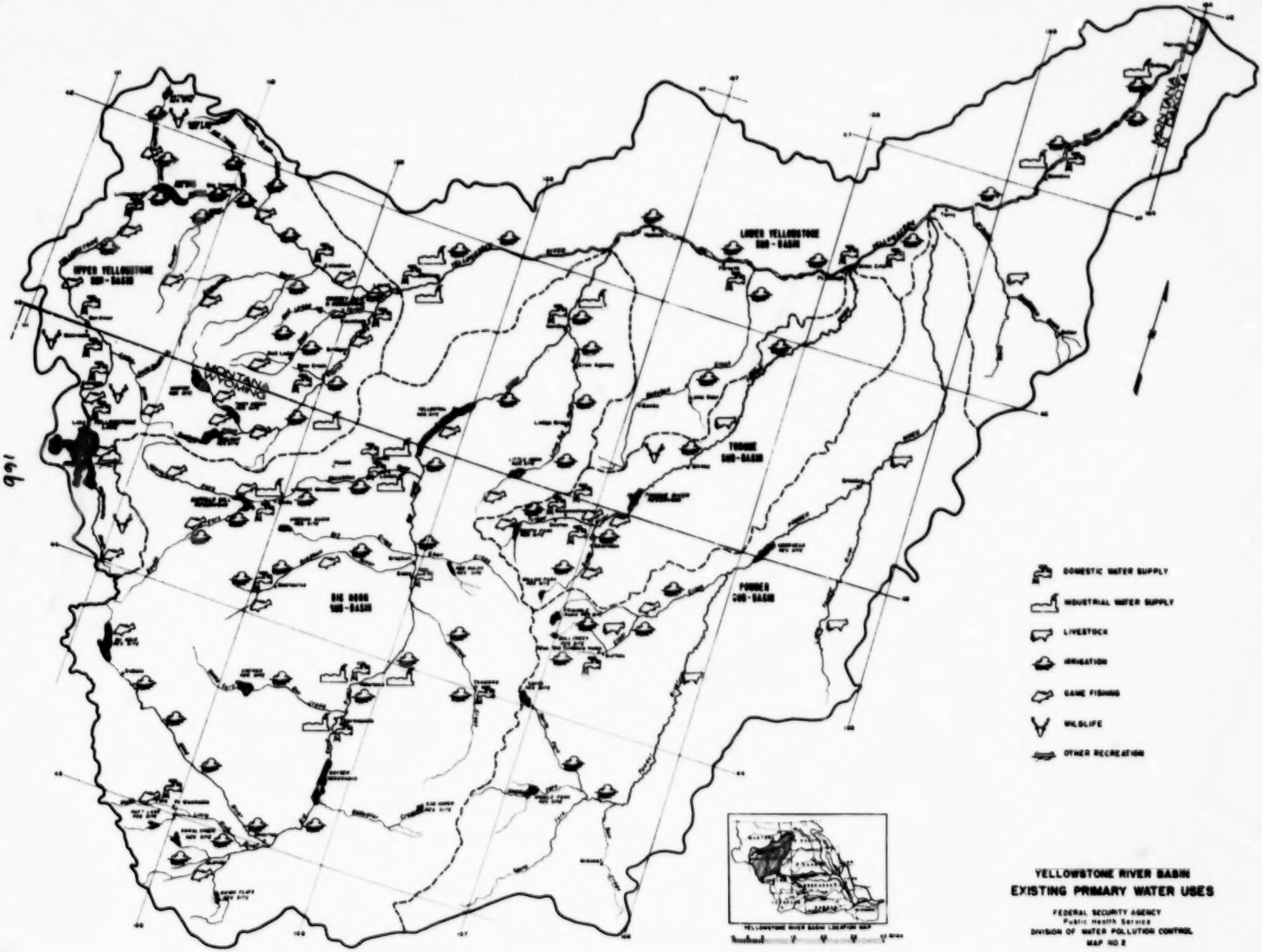
Sub-Basin	Stream	Tributary	Municipality and state	Treatment[1]		Estimated population served (4)	Average consumption M.G.D.
Upper Yellowstone	Yellowstone		Gardiner, Mont.	D		500	-
			Livingston, Mont.	CFD		8,500	1.87
			Columbus, Mont.	CD		835	-
			Laurel, Mont.	CD		4,000	1.84
		Clarks Fork	Fromberg, Mont.[3]	D		620	-
		West Fork Rock Creek	Red Lodge, Mont.	F		3,500	-
		Bear Creek	Bearcreek, Mont.	F		500	-
					Total	14,955	
Lower Yellowstone	Yellowstone		Billings, Mont.	CFD		26,180	3.300
			Forsyth, Mont.	CFD		1,700	0.173
			Miles City, Mont.	CFDS		6,000	0.750
			Glendive, Mont.	CFDS		4,630	0.40
					Total	38,510	
Big Horn River	Big Horn		Thermopolis, Wyo.[3]	D		2,300	0.25
			Worland, Wyo.	FD[3]		1,600	0.20
		Barnwood Creek	Tensleep, Wyo.	F		300	0.10
			Basin, Wyo.	CFD		900	.225
		Greybull River	Meeteetse, Wyo.	F		400	-
		Shoshone River Shoshone Canal	Cody, Wyo.	FD		5,000	0.70
			Deaver, Wyo.	F		35	-
			Cowley, Wyo.	F		850	0.15
			Lovell, Wyo.	CFD		2,400	0.50
			Hardin, Mont.	CFD		1,500	0.18
					Total	10,535	
Tongue River	Tongue River		Dayton, Wyo.	F		200	-
			Manchester, Wyo.	D		190	0.005
		Goose Creek	Sheridan, Wyo.	CFD		8,000	1.00
					Total	8,390	
Powder River	Powder River	Clear Creek	Buffalo, Wo.	(Chlorination summer only) (Filtration winter only)		2,500	0.30
					Total	2,500	

[1]Treatment - S - Softening
C - Chemical Precipitation
F - Filtered
D - Chlorination
N - No Treatment

[2]Auxiliary gravel wall wells located along North Platte River

[3]Infiltration gallery with partial disinfection

[4]From Public Health Service Inventory Water & Sewage Facilities in the United States - 1948.



YELLOWSTONE RIVER BASIN
EXISTING PRIMARY WATER USES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 2

POLLUTION CONTRIBUTED TO WATER RESOURCES

The Upper Yellowstone River drains the section of the Yellowstone Basin located above its junction with the Clarks Fork River (map No. 1). In this portion of the Basin 21,300 persons residing in 11 communities are served by sewer systems. Ten of the 11 sewered places provide some degree of treatment for the domestic sewage prior to its discharge to the watercourses. It is estimated that the strength of wastes as discharged in the Upper Yellowstone Sub-Basin has an organic population equivalent of 18,000 people, indicating a removal of not more than 15 percent of the biochemical oxygen demand[1].

Treatment works consisting of septic tanks are located at Canyon and Mammoth in Yellowstone Park, and at Gardiner, Big Timber, Columbus, Bear Creek, and Bridger in Montana. Livingston, Montana, discharges untreated sewage directly to the Yellowstone River.

Gardiner, Montana, which is located astride the Yellowstone River, has sewer service for only a portion of the town. The septic tank, although located on the south side of the river, does not serve all residences on that side. Considerable discussion has occurred regarding the installation of a sewage system and treatment plant on the north side, but to date no action has been taken.

Waters of the Upper Yellowstone Sub-Basin receive a considerable amount and variety of industrial waste. Wastes include those from railroad shops, oil refineries, canning plants, and from mining operations.

The only industry in Wyoming in this portion of the Basin is the Resolute Oil Refinery. This refinery is located in the Clarks Fork River watershed, but is sufficiently distant from the stream that the liquid wastes evaporate before reaching it.

The Northern Pacific Railroad has large maintenance shops at Laurel and Livingston, Montana. The waste lines from these shops carry a considerable quantity of oil. Oil separators have been installed at both shops, however they have not been very effective, primarily because of improper maintenance. Likewise, the Farmers' Co-Op Oil Refinery at Laurel, Montana, loses a considerable amount of oil in spite of its attempts to correct this condition by using a separator. In the latter instance water soluble wastes escape from the refinery and find their way into the ground water which is later intercepted by a highway drainage system. The effluent from the drainage system is foul smelling and has been the subject of many complaints.

The waste from the canning plant at Red Lodge is discharged into a creek tributary to the Clarks Fork River. Only minor treatment is provided.

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[1]The term biochemical oxygen demand is a measure of the oxygen required in the biochemical oxidation of organic material under standard conditions, including time and temperature. The terms biochemical oxygen demand and population equivalents are used to describe the strength of organic wastes.

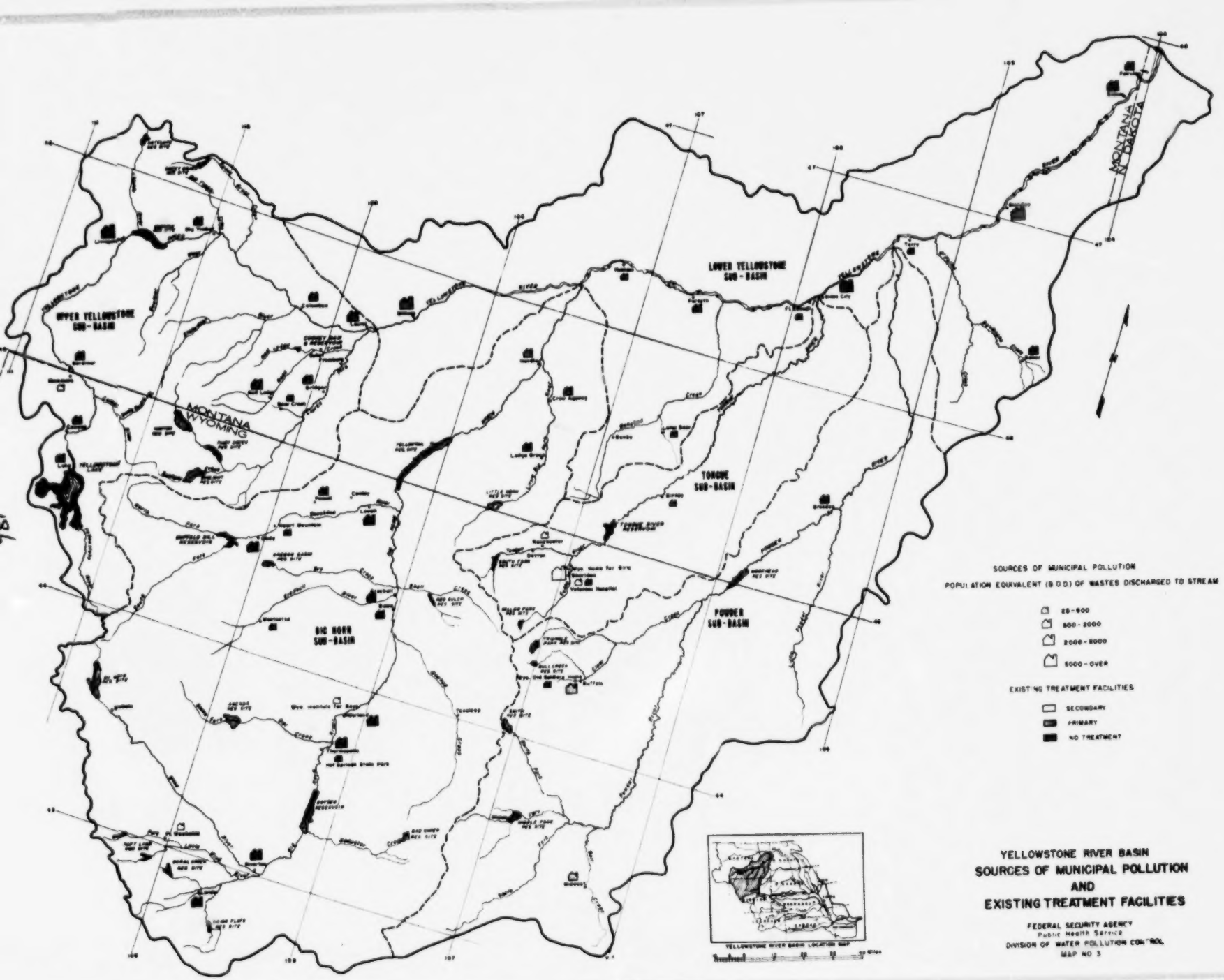
Mining operations have been rather extensive throughout this region. Mills processing gold ore at Cooke City, Montana, contribute rock flour and silt and have been suspected of periodically losing cyanide solution to Soda Butte Creek, thence to the Lamar River, a tributary of the Yellowstone River. These mills have attempted unsuccessfully to pond their wastes. Frequent washouts of the ponds indicate that it is not an entirely practical method of removing the mill wastes from the watercourses.

Gold, silver, and arsenic have been mined in considerable quantities near Jardine, Montana. Settling ponds have been constructed for storing the tailings from these operations. In former years the tailings, including a very insoluble arsenical ore, were discharged regularly into Bear Creek, a tributary of the Yellowstone River.

A gold dredge operating in a tributary of the Yellowstone River between Gardiner and Livingston, Montana, discharged so much silt to the river that the cost of water treatment to the City of Livingston was greatly increased. The dredging operations have now ceased. Chrome ore was mined in the vicinity of Columbus, and Red Lodge, Montana, during World War II, but has since been discontinued. Large quantities of coal exist near Red Lodge, Washoe, and Bear Creek, Montana. Mining operations are, however, practically at a standstill at the present time.

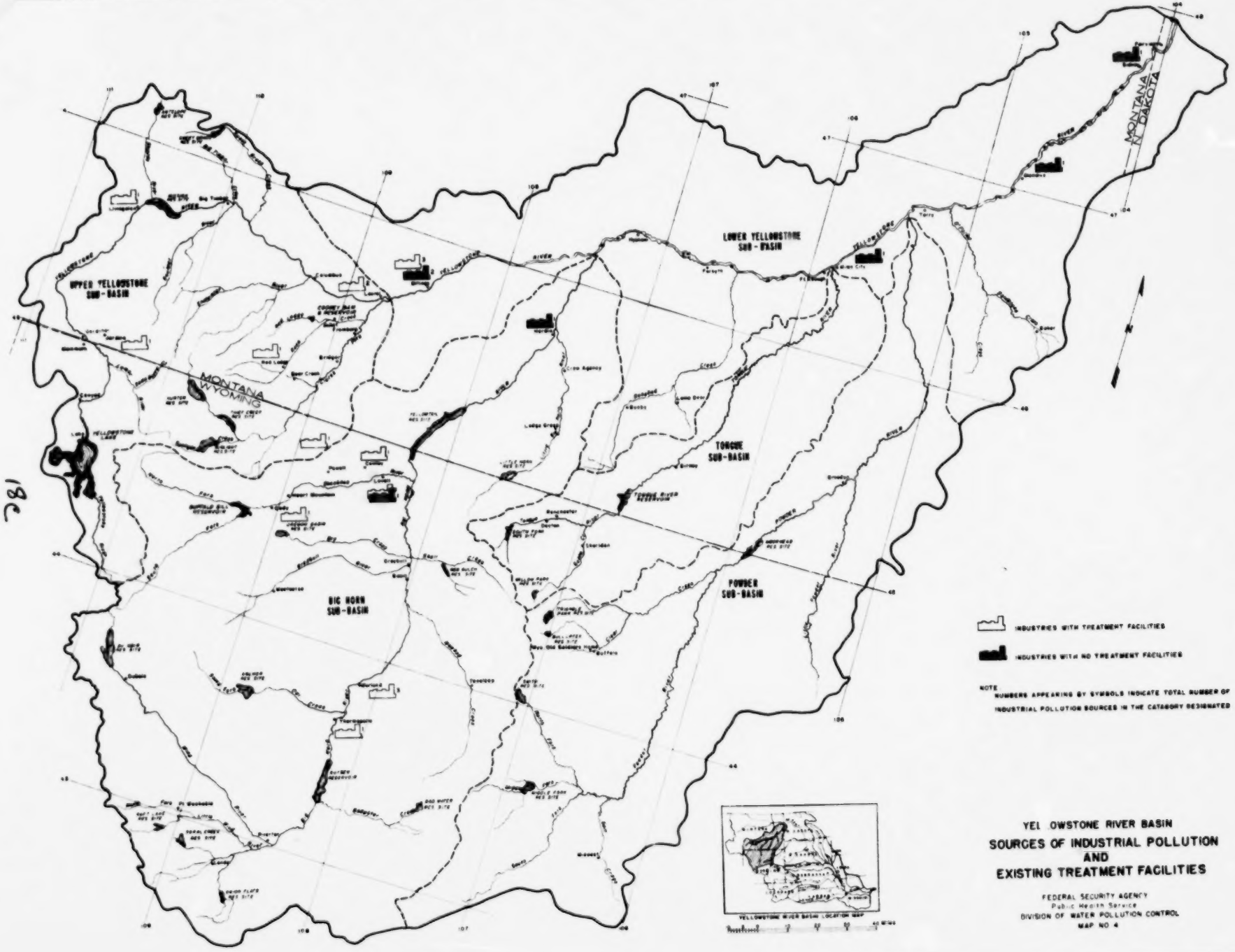
The Lower Yellowstone Sub-Basin is that portion of the river downstream from the mouth of the Clarks Fork River (map 3 & 4). There are 11 communities in this portion of the Basin which have municipal sewer systems serving about 49,000 people. Four of these discharge untreated sewage directly to the river, four have septic tanks, two have Imhoff tanks, and one has primary treatment with separate sludge digestion. The City of Billings, Montana, having a sewered population of about 30,000 people, discharges sewage to a primary sewage treatment plant placed in operation in May 1950. However, the pollution problem at Billings remains critical because of the large amount of industrial waste discharged without benefit of treatment. The Great Western Sugar Company at Billings has facilities for processing an average of 3,625 tons of sugar beets per day, and discharges its wastes to the river. It is estimated that these seasonal wastes are equivalent organically to that produced by 400,000 people. Other industries discharging wastes without treatment include a meat packing plant and a large cannery. Two oil refineries discharge treated wastes. Both refineries are now and were placed in operation during the fall of 1949. The waste treatment facilities in these plants were approved by the Montana State Board of Health prior to their installation.

The community of Hysham, Montana, has an old septic tank which has provided ineffectual treatment. The effluent is discharged into an open ditch through which it flows a distance of about one mile before reaching the Yellowstone River. Forsyth, Montana, provides primary treatment of sewage prior to discharging it into the Yellowstone River. The small Indian community of Lame Deer, Montana, which has a population of about 200 people, discharges sewage through a septic tank to Rosebud Creek, which enters the Yellowstone River immediately below Forsyth. The Montana State Department of Agriculture maintains an experiment station at Fort Keough which is located about two miles upstream from Miles City.



YELLOWSTONE RIVER BASIN
SOURCES OF MUNICIPAL POLLUTION AND EXISTING TREATMENT FACILITIES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 3


UPPER YELLOWSTONE SUB-BASIN
LOWER YELLOWSTONE SUB-BASIN
TORGUE SUB-BASIN
POWDER SUB-BASIN
BIG HORN SUB-BASIN
MONTANA WYOMING
MONTANA N. DAKOTA
INDUSTRIES WITH TREATMENT FACILITIES
INDUSTRIES WITH NO TREATMENT FACILITIES
NOTE
NUMBERS APPEARING BY SYMBOLS INDICATE TOTAL NUMBER OF INDUSTRIAL POLLUTION SOURCES IN THE CATAGORY DESIGNATED
YELLOWSTONE RIVER BASIN LOCATION MAP

YEL OWSTONE RIVER BASIN

SOURCES OF INDUSTRIAL POLLUTION AND EXISTING TREATMENT FACILITIES

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 4

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The sewage from 75 persons employed at the experiment station is discharged untreated to the Yellowstone River. The sewer outlet is on the same side of the river and about two miles upstream from the Miles City water treatment plant.

Miles City, population 9,180, discharges untreated sewage into the Yellowstone River. This rapidly growing community has recently become the site of a Veterans' Administration Hospital, and it is anticipated that the sewage volume will become greater. In addition to domestic wastes at Miles City, the Chicago, Milwaukee, St. Paul and Pacific Railroad maintenance shops discharge both industrial and sanitary wastes to a nearby slough which ultimately drains into the river. The stagnant wastes have created a nuisance which the railroad company has agreed to allay by removing the sanitary sewage and discharging it to the city sewers. The oil wastes will continue to reach the stream through the slough.

The Town of Terry, Montana, has a sewer system, including a septic tank, but has no municipal water supply. This unique situation has been brought about by the presence of numerous flowing wells within the community. The City of Glendive, Montana, discharges raw sewage through several outlets. In addition to domestic sewage from the 5,000 inhabitants of the city, the Northern Pacific Railroad maintenance shops discharge both sanitary and industrial wastes without treatment.

Sidney, Montana, discharges untreated sewage from about 3,000 persons directly to the Yellowstone River. The Holly Sugar Company Refinery, located in Sidney, seasonally discharges to the river beet wastes having an organic population equivalent of about 200,000.

The City of Fairview, Montana, has provided primary treatment (Imhoff tank) and discharges the treated wastes to a drain tributary to the Yellowstone River. Baker, Montana, has an obsolete treatment plant. Sewage from the municipality is producing nuisance conditions in the receiving stream.

In the Sub-Basin only about 20 percent of the pollutional material in domestic sewage is removed by treatment, and a smaller percentage is removed from industrial wastes. In addition to the domestic and industrial wastes cited, a considerable quantity of dissolved mineral salt leached from the soil by irrigation water is brought to the river by the numerous return and waste water ditches. The effect of this mineralization on the waters of the river has not been studied, however its influence on the ultimate usage of the waters should not be minimized.

There are 17 sewered places serving about 33,000 persons in the area drained by the Big Horn River (map No. 3). Eleven of these communities discharge untreated sewage into the Big Horn or its tributaries. Slightly over two percent of the biochemical oxygen demand of the domestic wastes is removed by treatment. Untreated sewage is discharged from Lander, Riverton, Thermopolis, Hot Springs State Park, Worland, Basin, Greybull, Cody, Powell, and Lovell, Wyoming, and Lodge Grass, Montana.

The principal sources of industrial waste in the Big Horn Sub-Basin are the oil and beet sugar refineries. The Husky Oil Refining Company maintains a plant east of Cody, Wyoming. The Empire State Oil Refining Company maintains a plant in Thermopolis, Wyoming, and the Ohio Oil Company has a refinery near Lovell, Wyoming. Eight miles north of Worland, Wyoming, the Pure Oil Company and Texas Gulf Sulphur Company maintain plants to remove the hydrogen sulfide and lighter petroleum products from the crude oil. The hydrogen sulfide is converted to elemental sulfur. Wastes from the oil fields themselves have not posed a pollutional problem in the past. Most of the crude oil contains a rather high sulfur content, but is remarkably free of other mineral contamination. The principal sources of organic industrial wastes within the Big Horn Sub-Basin are three sugar refineries. The Great Western Sugar Company has a plant at Lovell, Wyoming, and the Holly Sugar Company has refineries at Worland, Wyoming, and Hardin, Montana. It is estimated that the three beet sugar refineries contribute about 600,000 population equivalents of organic material daily to the waterways of the Sub-Basin during the period of operation While the effect of the waste on the streams has not been completely determined, industrial wastes are suspected as the cause of taste and odor problems in downstream water supplies.

Irrigation waste and return waters may contain much mineral matter and silt.

There are five places in the Tongue River drainage basin which have sewer systems, four of which include treatment (map No. 3). The five systems serve 16,250 people. The four treatment plants remove about 55 percent of the biochemical oxygen demand of the organic wastes.

The effects of mineral salts in the irrigation return water on the waters of the Tongue River have not been determined.

Four thousand two hundred persons residing in four sewered places contribute wastes to streams of the Powder River Sub-Basin (map No. 3). The largest of these, Buffalo, Wyoming, population 2,700, provides septic tank treatment with chlorination of the effluent. The Wyoming Old Soldiers Home has recently completed a new treatment plant. The waters of Clear Creek, into which the Town of Buffalo and the Old Soldiers Home discharge treated wastes, are diverted for irrigation purposes a short distance below the Buffalo outfall. Midwest, Wyoming, has satisfactory treatment. Broadus, Montana, discharges untreated wastes into the Powder River. The extremely erratic flows in the Powder River make it an unreliable source of dilution water, and a rather high degree of treatment for sewage should be maintained to avoid nuisance conditions during that period of the year when the flows are extremely low or have ceased.

Tables 7 and 8 list in descending order, beginning at the stream headwaters, sources of municipal and industrial pollution of the Yellowstone River and its tributaries.

Table 7. Yellowstone River Basin. Basic data on sources of municipal pollution

Receiving stream and name and location of municipality	Miles from mouth of river	Population served by sewers	Total P. E. of untreated wastes	Treatment provided	Adequacy of treatment facilities Cap'y.	Oper.	P.E. Discharged to watercourse	Project needs	Current status of municipal action
Yellowstone River									
Lake, Yellowstone Park, Wyo.	594.5	1,000	1,000	Primary	Sat.	Sat.	800	-	-
Canyon, Yellowstone Pk, Wyo.	579.9	1,550	1,550	Primary	Sat.	Sat.	1,250	-	-
Mammoth, Yellowstone Pk, Wyo.	539.0	1,100	1,100	Secondary	Sat.	Sat.	220	-	-
Gardiner, Mont.		850	850	Primary	Uns.	Uns.	760	E	Inactive
Livingston, Mont.	476.2	6,700	6,813	None	-	-	6,813	NP	Inactive
Big Timber, Mont.	436.4	1,280	1,388	Primary	Uns.	Sat.	1,024	E	Inactive
Columbus, Mont.	396	1,000	1,051	Primary	Sat.	Sat.	900	-	-
Laurel, Mont.		4,000	4,000	Primary	Sat.	Sat.	2,800	-	-
Clarks Fork River	363.7								
Rock Creek									
Red Lodge, Mont.		3,000	3,000	Primary	Sat.	Sat.	2,700	-	-
Bear Creek									
Bear Creek, Mont.		150	150	Primary	Sat.	Sat.	125	-	-
Bridger, Mont.		720	745	Primary	Sat.	Sat.	575	-	-
Yellowstone River									
Billings, Mont.	346.0	30,000	30,000	Primary	Sat.	Sat.	20,000	A	Inactive
Big Horn River	279.4								
Wind River	336.0								
Shoshone Indian Reservation Headquarters, Wyo. (Ft. Washakie)		250	250	Secondary	Sat.	Sat.	50	-	-
Popo Agie River									
Lander, Wyo.		4,000	4,000	None	-	-	4,000	NP	Inactive
Riverton, Wyo.	336.0	4,500	4,500	None	-	-	4,500	NP	Inactive
Thermopolis, Wyo.	270.4	4,000	4,000	None	-	-	4,000	NP	Final plans approved
Hot Springs State Park		250	250	None	-	-	250	NP	Final plans approved
Wyoming Inst.for Boys, Wyo.		200	200	Secondary	Sat.	Sat.	100	-	-
Worland, Wyo.		4,000	4,000	None	-	-	4,000	NP	Inactive
Basin, Wyo.		1,500	1,500	None	-	-	1,500	NP	Inactive
Greybull River	183.0								
Meeteetse, Wyo.	53.8	400	400	Primary	Sat.	Sat.	265	-	-
Greybull, Wyo.		1,900	1,900	None	-	-	1,900	NP	Inactive
Shoshone River	136.2								
Cody, Wyo.		3,800	3,800	None	-	-	3,800	NP	Inactive
Heart Mountain, Wyo.		200	200	Primary	Sat.	Sat.	150	-	-
Bitter Creek									
Powell, Wyo.		1,200	1,200	None	-	-	1,200	NP	Inactive
Lovell, Wyo.	11.5	3,000	3,000	None	-	-	3,000	NP	Inactive
Hardin, Mont.	40.5	1,800	1,800	Primary	Sat.	Sat.	1,440	-	-
Little Big Horn River	40.5								
Lodge Grass, Mont.	77.3	840	840	None	-	-	840	NP	Inactive
Crow Indian Hdq. Mont.	14.0	800	800	Primary	Uns.	Uns.	800	R	Planning initiated
Hysham, Mont.		275	275	Primary	Uns.	Uns.	250	E	Inactive
Forsyth, Mont.	230.8	2,000	2,000	Primary	Uns.	Uns.	1,600	E	Inactive
Rosebud Creek									
Deer Creek									
Lame Deer, Mont.		50	50	Primary	Sat.	Sat.	45	-	-
Ft. Keough, Mont.	182.0	75	75	None	-	-	75	NP	Inactive
Tongue River	181.5								
Ranchester, Wyo.		200	200	Secondary	Sat.	Sat.	50	-	-
Goose Creek	211.7								
Sheridan, Wyo.		15,000	15,000	Secondary	Uns.	Sat.	7,000	E	Inactive
Wyo. State Home for Girls		75	75	None	-	-	75	NP	Under constr.
Vet. Admin. Hospital, Wyo.		1,000	1,000	Secondary	Sat.	Sat.	100	-	-
Birney, Mont.		50	50	Primary	Sat.	Sat.	35	-	-
Yellowstone River									
Miles City, Mont.	180.8	7,200	7,236	None	-	-	7,236	NP	Inactive
Powder River	146.6								
Salt Creek	353								
Midwest, Wyo.		700	700	Primary	Sat.	Sat.	500	-	-
Powder River									
Clear Creek	210								
Buffalo, Wyo	79.9	3,000	3,000	Primary	Uns.	Uns.	2,400	E	Inactive
Wyo. St.Old Solders Home		60	60	Secondary	Sat.	Sat.	15	-	-
Broadus, Mont.		500	500	None	-	-	500	NP	Inactive
Terry, Mont.	134.5	500	500	Primary	Sat.	Sat.	450	-	-
O'Fallon Creek	95.0								
Sandstone Creek									
Baker, Mont.		1,600	1,600	Primary	Uns.	Uns.	1,600	E	Inactive
Glendive, Mont.	92.1	5,060	5,132	None	-	-	5,132	NP	Inactive
Sidney, Mont.	30.2	3,000	3,036	None	-	-	3,036	NP	Inactive
Fairview, Mont.		1,200	1,200	Primary	Sat.	Sat.	960	-	-

Sat. - Satisfactory
Uns. - Unsatisfactory
A - Chlorination
E - Enlargements
NP - New Plant
R - Replacement

Table 8. Yellowstone River Basin. Basic data on sources of industrial pollution - Industries discharging wastes directly to watercourse

Name and location	River mileage above mouth	Type of industry	Type of waste produced	Treatment or other pollution control measure: Degree	Treatment or other pollution control measure: Adequacy	Estimated P.E. (organic) discharged to watercourse	Project needs	Status
Yellowstone River								
Bear Creek								
Jardine Mining Co. Ore Mill Jardine, Mont.	960	Primary metals	Inorganic	Partial	Inadequate	-	Add'l. control measures	Inactive
Yellowstone River								
Northern Pacific R.R. Maintenance Shop Livingston, Mont.	475	Miscel.	Inorganic & organic	Partial	Inadequate	Unknown	New plant or other control measures	Inactive
Co-op. Oil Refinery Laurel, Mont.	365	Petroleum	Inorganic & organic	Partial	Inadequate	Unknown	Add'l. control measures	Inactive
Northern Pac. R.R. Maintenance Shop Laurel, Mont.	364	Miscel.	Inorganic & organic	Partial	Inadequate	Unknown	Add'l. control measures	Inactive
Clarks Fork River								
Mesolute Oil Co.	-	Petroleum	Inorganic & organic	Complete	Adequate	Unknown	No project	-
Rock Creek								
Red Lodge Cannery Red Lodge, Mont.		Food & Kindred Products	Organic	Minor	Inadequate	Unknown	Add'l. control measures	Inactive
Great Western Sugar Co. Ref. Billings, Mont.	345	Food & Kindred Products	Organic	None	Inadequate	400,000	New plant or other control measures	Inactive
Continental Oil Co. Ref. Billings, Mont.	343	Petroleum	Inorganic & organic	Partial	Adequate	Unknown	No project	-
Pierce Packing Co. Plant Billings, Mont.	343	Food & Kindred Products	Organic	Partial	Inadequate	Unknown	New plant or other control measures	Inactive
Midland Packing Co. Plant (Cannery) Billings, Mont.	343	Food & Kindred Products	Organic	None	Inadequate	Unknown	New plant or other control measures	Inactive
Carter Oil Co. Refinery Billings, Mont.	340	Petroleum	Inorganic & organic	Partial	Adequate	Unknown	No project	-
Big Horn River	279							
Empire State Oil Ref. Thermopolis, Wyo.	270	Petroleum	Inorganic & organic	Partial	Inadequate	Unknown	Enlarge	Inactive
Holly Sugar Co. Ref. Worland, Wyo.		Food & Kindred Products	Organic	Minor	Inadequate	200,000	New plant or other control measures	Inactive
Pure Oil Co. Ref. Worland, Wyo.	225	Petroleum	Inorganic & organic	Partial	Inadequate	Unknown	Add'l. control measures	Inactive
Texas-Gulf Sulfur Plant Worland, Wyo.	224	Petroleum	Inorganic	Partial	Adequate	Unknown	No project	-
Shoshone River	136							
Husky Oil Refining Co. Cody, Wyo.	60	Petroleum	Inorganic & organic	Partial	Inadequate	Unknown	New plant or other control measures	Inactive
Cowley Canning Co. Cowley, Wyo.	-	Food & Kindred Products	Organic	Minor	Inadequate	4,100	New plant or other control measures	Inactive
Ohio Oil Co. Ref. Lovell, Wyo	14	Petroleum	Inorganic & organic	Partial	Adequate	-	-	-
Great Western Sugar Co. Ref. Lovell, Wyo	11	Food & Kindred Products	Organic	None	Inadequate	200,000	New Plant	Inactive
Holly Sugar Co. Ref. Hardin, Mont.	40	Food & Kindred Products	Organic	None	Inadequate	200,000	New plant or other control measures	Inactive
Yellowstone River								
C.M. St.P. & Pac. R.R. Maintenance Shops Miles City, Mont.	180	Miscel.	Inorganic & organic	None	Inadequate	Unknown	New plant or other control measures	Inactive
Tongue River								
Northern Pac.R.R. Main. Shops Glendive, Mont.	92	Miscel.	Inorganic & organic	None	Inadequate	Unknown	New plant or other control measures	Inactive
Holly Sugar Co. Ref. Sidney, Mont.	30	Food & Kindred Products	Organic	None	Inadequate	200,000	New plant or other control measures	Inactive

DAMAGES TO WATER RESOURCES FROM POLLUTION

In the Upper Yellowstone Sub-Basin most stream pollution complaints have been related to destruction of aquatic life. The National Park Service has voiced its concern about pollution from mining industries on Soda Butte Creek, which is a tributary of the Lamar River. These industries, located in the vicinity of Cooke City, Montana, use a cyanide process for separating gold from the ore. It has been reported from time to time that tailing ponds and cyanide settling ponds have washed out, permitting the discharge of wastes directly to the waterway, killing fish and other aquatic life.

The mining company at Jardine, Montana, now impounds all of its tailings, when in operation, but at various times in the past has discharged wastes directly to Bear Creek, a tributary joining the Yellowstone near Gardiner, Montana. The tailings contain considerable quantities of combined arsenic. There have been no reported ill effects from usage of this water, nevertheless, a real danger is present if arsenic gains entrance to the stream.

For several years a gold dredge, operating in the vicinity of Emigrant, Montana, discharged a very turbid water to the Yellowstone River, causing concern among the various groups interested in fishing in this region. The cost of water treatment for the City of Livingston, Montana, was increased considerably by the added turbidity. The dredge has now been removed, but it is entirely possible that in the future other areas in this vicinity may appear desirable for similar operations.

Complaints have been filed with the Montana State Board of Health concerning the condition of the river near Laurel, Montana, where the flesh of the fish allegedly absorbs various petroleum products, making the fish undesirable for eating. There are two sources of petroleum wastes in the vicinity of Laurel: the oil refinery and the Northern Pacific Railroad shops. Considerable additional action is indicated in order to correct this pollution. Upon the recommendations of the Montana State Board of Health the wastes from the oil refinery and from the Northern Pacific Railroad are being passed through gravity separators in an attempt to retain petroleum products. Untreated waste from the highway drain at Laurel is continuously discharged to the river. The odor of this waste indicates that it probably contains mercaptans released during the processing of gasoline.

The Montana State Fish and Game Department reports that poor irrigation practices permit a great deal of silt to wash into the Clarks Fork River. The silt blankets the aquatic growths on the stream bottom, thereby destroying fish food.

The Huntley Project, one of the early Bureau of Reclamation projects, is located about 15 miles downstream from Billings, Montana. This project includes approximately 25,300 acres and sustains an estimated population of 3,000 persons. Since the ground water throughout most of this area is highly mineralized, most individuals once obtained their drinking water from the irrigation ditches. The irrigation water was filtered, chlorinated, and stored in cisterns for drinking and household uses. The use of irrigation water for domestic purposes has been

discontinued during recent years. Bacterial contamination from sewage, and objectionable tastes from the oil refinery wastes, have made the irrigation water unfit for drinking. As a result the residents of the Huntley Project have been forced to haul water from the Billings municipal supply or from a well owned by the Bureau of Reclamation located in the vicinity of Ballantine, Montana.

Figures available indicate that water hauled from one of the few satisfactory wells in this area costs 25¢ a tank wagon (750 gallons) at the source and $2.50 delivered. If each person living on the project utilizes 30 gallons of water per day, it would cost 10¢ per capita per day, or for 3,000 persons $300 per day, or $109,500 per year for water delivered to the individual cisterns. Since the cost of treating unpolluted irrigation water is estimated to be about $7,000 annually, damages of $102,500 each year are credited to pollution originating in and near Laurel and Billings, Montana.

It was reported by the Montana Fish and Game Commission that prior to 1950 fish in a 55 mile stretch of the stream below Laurel were unsatisfactory for eating because of an oily taste.

Residents downstream from the sewer outlets in Glendive have complained about a serious odor nuisance created by sewage which spreads along the banks of the Yellowstone River from the community of Glendive during periods of low stream flow. This condition decreases the value of real estate in this area.

The Big Horn Sub-Basin has eleven communities and two industries discharging untreated wastes (maps 3 and 4). Ten communities and eight or more industries of the Sub-Basin are dependent upon surface supplies for their water. Tastes and odors apparently due to industrial wastes have periodically created serious problems at Basin, Wyoming, and Hardin, Montana. Cody, Wyoming, has experienced difficulty with tastes and odors of biological origin from a storage reservoir. Tastes and odors having their origin in the Big Horn Sub-Basin have been reported by municipal surface water treatment plants located as far downstream as Glendive, Montana, in the Lower Yellowstone region. The industries are reportedly attempting to remove their more potent wastes from the stream and discharge only relatively innocuous material.

In the Tongue River Sub-Basin pollution occurs in the vicinity of Sheridan, Wyoming. Further study is required to properly evaluate damages to water resources which occur in this Sub-Basin.

Very little information is available relative to pollution of water and the resulting damage in the Powder River Basin. Studies made in the vicinity of Broadus, Montana, indicate very little use of the water for any purposes whatsoever due to the character of the stream and its banks. It has been reported that stock do not graze along the banks of the lower sections of the river due to quicksand. The stream is so turbid in Montana that it is not desirable for fishing or recreation, and no industries other than agriculture are reported as dependent upon the stream for water supply. There is some excellent fishing in the upper reaches of the river. Much of the upstream area is dude ranch country, which caters to a large tourist clientele.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

The greatest need for abating pollution has been in the vicinity of Billings, extending roughly from Laurel to Custer, Montana. The Billings area is highly industrialized and populated. The benefits of the recently completed sewage treatment plant should be realized in this region during and after the 1951 summer season. The residents of the Huntley Project presented a formal petition to the Montana State Board of Health in 1940 requesting relief from the pollution. After studying the conditions, the State Board of Health issued orders to abate pollution from the cities of Laurel and Billings; the oil refinery and Northern Pacific Railroad at Laurel; and the sugar factory and oil refinery at Billings. Because of this order, Laurel and Billings have recently placed new sewage treatment plants in operation. The sugar factory has removed its lime waste from the stream. The offending oil refinery in Billings ceased operations and the company has constructed a modern oil refinery further downstream (stream pollution was not the only factor that influenced this move). The oil refinery and the Northern Pacific railroad at Laurel have improved their disposal facilities, and in general a clean-up program has been inaugurated in this portion of the stream. The beneficial results of this program became evident when the new sewage treatment plants at Billings and Laurel were placed in operation.

Information received from the Montana Fish and Game Department indicates that when oil pollution in the river is eliminated, game fish in this area will lose their oily taste and in a short time return to their natural state. If fish in the region become palatable it can be anticipated that there will be more fishing by tourists, with the resultant increase in the value of tourist trade throughout this area. The sale of fishing licenses and fishing equipment will increase correspondingly, thus adding to the value of the tourist industry.

If silt can be controlled considerable savings can be realized at the various water filtration plants along this section of the river. The silt problem is serious at Basin and Lovell, Wyoming, and at Hardin, Forsyth, Miles City, and Glendive, Montana. It is probable that the proposed reservoirs on the Big Horn and Powder Rivers will to some extent alleviate this source of trouble.

No figures are available as to the benefits which have resulted from the reduction of pollution from the various oil refineries in Wyoming. It is a logical assumption, however, that if no gravity oil separators were installed on the discharge lines from these oil refineries, large amounts of oil would find their way into the streams and from the streams into the various irrigation ditches located along their channels, causing considerable damages to all water uses. Oil-bearing waters are reported as being particularly harmful to irrigated crops and irrigated lands. Oil separators usually more than pay for themselves in oil recovered and saved for the refinery. The simple expedient of installing oil separators has been considered common practice by the oil refineries. They have found such installations to be economically desirable, and people living along the stream have taken the installation of separators as a matter of course. If a serious breakdown does occur at an oil refinery, and a large amount of oil is discharged into the watercourse,

the residents downstream immediately complain. Problems of taste and odors in public water supplies would be reduced and perhaps eliminated when all oil is removed from the streams. Other industries and communities along the watercourses must also recognize a similar responsibility when disposing of their wastes.

The benefits mentioned above can be given a value. There are, however, many intangibles that may have a greater over-all value than the tangible benefits. Public health improvement is a most important intangible value which comes with clean streams. The polluted stream is a vector for many diseases of both man and animal. Among the intangible benefits which are obtained from a clean stream is the psychological effect of clean water upon all who contact it. While fishing values are tangible a stream's natural beauty may attract people from long distances who do not fish but merely picnic, hike, boat, or photograph the scenery. Clean streams attract people, who in turn attract enterprises.

POLLUTION PREVENTION MEASURES IN EFFECT

The general attitude of the residents of the Yellowstone Basin indicates a desire to reduce or eliminate pollution from the streams. This interest has been stimulated by the State Health Departments of the Basin, who are attempting to reduce pollution as fast as possible.

Present municipal sewage treatment works can be credited with removing about 20 percent of the pollution caused by domestic waste. The percentage of population equivalents removed from organic industrial waste is very small. Untreated wastes from sugar refineries and canning factories contribute the major portion of the organic pollution.

In Wyoming a considerable problem of financing sewage treatment plants has existed for some time. Constitutional limitations on the municipal bonded indebtedness restricted municipalities in their ability to construct sewage treatment plants. The Wyoming State Supreme Court has recently rendered a decision permitting the issuance of revenue bonds to finance sewage treatment works. This will greatly aid in financing the construction of municipal sewage treatment plants in that State.

New treatment works were placed in operation at Laurel and Billings, Montana, during the summer of 1950. A new sewage treatment plant is being constructed at Lake in Yellowstone National Park and one has recently been completed at the Wyoming Institute for Boys near Worland, Wyoming. The City of Sheridan, Wyoming, and the Veterans Administration Hospital near Sheridan are provided with modern treatment works, and chlorinate their sewage effluents as added treatment measures. In addition, 24 other cities and towns of the Basin provide varying degrees of treatment. See tables 9, 10, 11, and 12 for a summary of sewage treatment in the Yellowstone Basin.

The oil industry has interested itself in the protection of streams. Wastes from the larger refineries have been reduced by treatment, and it is to be anticipated that other industries will follow this lead.

Table 9. Yellowstone River Basin. Statistical summary of existing treatment facilities - Municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	23	23	56,100
Secondary	7	7	17,700
No treatment	18	-	52,400
TOTAL	48	30	126,200

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers; sanitary sewage wastes discharged by industry directly to watercourse and industrial wastes discharged into municipal sewage systems.

Table 10. Yellowstone River Basin. Existing treatment facilities - Industrial*

Type industry	Number of plants	Number of industrial plants having:		
		Treatment facilities	No treatment facilities	Undetermined facilities
Food and kindred products	9	3	6	0
Petroleum	9	9	0	0
Miscellaneous	4	2	2	0
Primary metals	1	1	0	0

*Industries having separate outlets and discharging wastes directly to watercourse.

Table 11. Yellowstone River Basin. Adequacy of existing treatment facilities -- Municipal and industrial

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisfactory	Unsatisfactory	Undetermined	Satisfactory	Unsatisfactory	Undetermined
Municipal*	30	22***	8	0	24	6	0
Industrial**	15	5	10	0	5	10	0

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, counties, towns, significant institutions, resorts, recreational centers or other population centers.

**Industries having separate outlets discharging wastes directly to watercourse.

***One plant included as "satisfactory" which needs chlorination as additional treatment.

Table 12. Yellowstone River Basin. Progress in pollution abatement

Year	Municipal		Industrial
	Plants completed	Design population	Plants completed
1946	0	-	1
1947	0	-	0
1948	0	-	0
1949	0	-	3
1950	3	40,000	0

In order to maintain proper operation of existing sewage treatment plants, short course schools are held each year for the operators in Montana, North Dakota, and Wyoming. At these schools problems of operation, theories of sewage treatment, and other matters of interest to operators are discussed. In addition the States' health department personnel regularly contact the individual operators at their plants and carefully review the operation with them.

Legislation permitting compacts between the various States in order to control interstate pollution has not yet been provided. It can be anticipated that such legislation will be forthcoming when the need becomes more apparent to the citizens of this region. The State Health Departments in the Basin are well received by municipalities and industries. This has made it possible for much to be accomplished without recourse to court action. The relationship which exists between the State Health Departments and the municipalities and industries is an indication of the respect which is held for the State Health Departments.

If the State water pollution control agencies can obtain sufficient qualified personnel and legislative backing, rapid progress will be made toward controlling pollution in the streams of the Yellowstone Basin.

Appendix A presents an analysis of the State laws pertinent to stream pollution in Montana, North Dakota, and Wyoming. Recent amendments to the Wyoming antipollution legislation broadens and strengthens it. Montana legislation deals only with the public health aspects of pollution control.

POLLUTION PREVENTION MEASURES NEEDED

Present water uses and increased or additional uses possible with improved water quality, together with protection of water rights and property values, largely determine the pollution prevention measures needed. The objective of water pollution control programs is to preserve or reclaim water to best serve these interests. Treatment requirements, like other aspects of water resources development, are generally influenced by economic consideration. In addition, the intangible aspects of moral obligation, aesthetic values, and nuisance conditions exert a powerful and positive influence on the justification of waste treatment facilities.

Water quality objectives have been fairly well developed for such water uses as domestic and industrial water supply, recreation, bathing, and for support of fish life. Objectives are less well defined for other uses.

Among the more important objectives of a water pollution control program is protection of water quality in streams used as sources of public water supplies. The quality of raw water is an important factor in the design of water treatment facilities and in their operation and maintenance. The factor of safety which can be incorporated in the best water treatment facility is, however, inversely proportional to the specific concentrations of bacteria and toxic elements in water used as source of supply. Therefore, public health and waterworks officials generally measure water quality in terms of its bacteriological, physical, and chemical characteristics. While definite standards of raw water quality have not been adopted, the Manual of Recommended Water Sanitation Practice, Public Health Service Bulletin No. 296, 1946, recommends the following practices: Underground waters not subject to any possible contamination and meeting in all respects the requirements of the Public Health Service Drinking Water Standards as shown by satisfactory, regular and frequent sanitary inspections and laboratory tests, require no treatment. Underground or surface waters which are subject to a low degree of contamination not averaging more than 50 coliforms (M.P.N.) per 100 ml. of sample in any month and meeting the requirements of the Public Health Service Drinking Water Standards in all other respects should receive a minimum of simple chlorination or its equivalent. Waters which require filtration treatment for turbidity and color removal, waters of high or variable chlorine demand, and waters polluted by sewage to such an extent as to be inadmissible in the prior groups, but containing numbers of coliform bacteria averaging not more than 5,000 coliforms (M.P.N.) per 100 ml. of sample in any one month and exceeding this number in not more than 20 percent of the samples examined in any one month, should be provided complete rapid sand filtration treatment or its equivalent, together with continuous postchlorination. Waters which meet the requirements of the previous statement with respect to the limiting monthly average coliform numbers but showing numbers of coliforms exceeding 5,000 M.P.N. per 100 ml. in more than 20 percent of the samples examined during any one month and not exceeding 20,000 per 100 ml. in more than 5 percent of the samples examined during any month, should be provided auxiliary treatment in addition to filtration and postchlorination. Auxiliary treatment as used here is presedimentation or prechlorination or their equivalents either separately or

combined as may be necessary. Long time storage for periods of 30 days or more represents a permanent and reliable safeguard which in many cases would provide something more than an effective substitute for one or both of the two other methods indicated. Waters which do not meet the requirements cited are considered unsuitable for use as sources of water supply unless they can be brought into conformance with the requirements by means of prolonged preliminary storage or some other measure of equal permanence and reliability, as heavy prechlorination and preliminary coagulation and sedimentation.

In addition to the recommended bacterial requirements, waters for public supply should not contain toxic, taste-producing, or otherwise harmful substances, or organisms not readily and completely removed by the water treatment processes cited, and should be free of excessive amounts of acid, microscopic organisms, and organic matters causing any interference with the normal operation and efficiency of the water treatment processes. Whether or not upstream domestic and industrial waste is treated often determines the acceptability of a stream as a source of domestic or industrial supply.

Standards adopted by the Public Health Service for Drinking and Culinary Water Supplied by Common Carriers in Inter-State Commerce prescribe limiting maximum concentrations of certain chemical substances inimical to public health, including the following:

Substance	Maximum concentration in parts per million
Lead	0.1
Fluoride	0.5
Arsenic	0.05
Selenium	0.05
Hexavalent chromium	0.05

These standards have received official approval by the American Water Works Association and general acceptance by official health agencies and water works authorities and are widely used as one of the guides for administration of water pollution control programs.

Also of importance are those substances which cause problems of taste and odors. Of particular concern are phenolic and related compounds, minute concentrations of which cause repugnant taste and odor in water supplies. Pollution control programs are aimed at virtual elimination of these substances in waters serving as a source of domestic supply.

Quality requirements for industrial water supply vary widely, depending upon the type and nature of industry under consideration. Of general concern are organic and biological constituents, toxic substances, and properties of corrosion, encrustation, and slime formation. Waste control measures often contribute materially to improvement of water quality.

It is generally agreed that a minimum of 5.0 parts per million of dissolved oxygen is necessary, in those streams of the Yellowstone

River Basin affording a suitable fishery habitat, for support of a balanced aquatic life, and that a minimum of 6.0 ppm. is desirable for trout streams. Because of limited dilution water during critical periods of low flow, secondary treatment, or removal of not less than 75 percent of the Biochemical Oxygen Demand, is required for a few sources of pollution in the Basin. A consistent removal approaching 85 percent is possible with secondary treatment facilities properly designed and well operated.

Water for recreational usage should be free from floating solids, sludge banks, odors, and discoloration. Contamination of bathing waters by sewage, especially that of recent origin, is objectionable. Recommended objectives for the bacteriological quality of bathing waters are as follows:

For bathing or swimming water, monthly arithmetical average 'most probable number' of coliform organisms should not exceed 1,000 per 100 ml. during any month of the recreational season; nor exceed this number in more than 20 percent of the samples examined during any such month; nor exceed 2,400 per 100 ml. on any day. For nonbathing or nonswimming waters, the monthly arithmetical average 'most probable number' or coliform organisms should not exceed 5,000 per 100 ml. in any month of the recreational season, nor should not exceed this number in more than 20 percent of the samples examined during any such month. Sanitary surveys must continue to play the major role in pollution control programs as related to bathing waters.

The State water pollution control agencies of Montana, North Dakota, and Wyoming, recommend as bacteriological objectives for irrigation water the following:

(1) Sewage used for irrigation of forage crops should be given treatment insuring a consistent reduction in coliform bacteria of not less than 90 percent.

(2) Sewage used for irrigation of human food crops should be given treatment insuring a consistent reduction (a) in suspended solids of not less than 75 percent, (b) in 5 day 20° C., B.O.D. of not less than 75 percent, and (c) in coliform bacteria of not less than 98 percent, unless discharged into a stream where the volume of dilution water, available during the low flow periods during which irrigation diversions may occur, is at least 10 times greater than the anticipated maximum daily volume of sewage, in which case a bacterial reduction of 90 percent may be acceptable.

Provided, however, that where the time of passage from plant discharge to irrigation diversion is such as to permit the normal death rate of bacteria as evidenced by the die-away curve to provide equivalent bacterial reduction, the requirement of (1) and (2) above may be appropriately modified.

The protection of water rights must also be considered in determining pollution prevention measures needed. The doctrine of riparian rights, widely applied in States east of the 98th meridian, holds that "all persons owning land abutting on a natural stream have a right to demand that the water shall pass their lands undefiled in quality and

undiminished in quantity."[1] The interpretations of the doctrine vary but in general a "reasonable" approach is applied in which stream uses are permitted which do not substantially lessen its quantity or impair its quality. West of the 98th meridian the doctrine of appropriated water rights is usually accepted, although in many areas State water laws incorporate a portion of both doctrines. Where the doctrine of appropriated water rights prevails, consumptive use of water is permitted but no license is thus given to return water to the stream in a defiled condition. The water laws of Montana and Wyoming are based on the doctrine of appropriated water rights.

Waste treatment measures are usually tailored to the needs of a community following the engineering evaluation of local sanitary problems. Municipal treatment plants are usually of two general types, one of which removes settleable material from the sewage under quiescent flow conditions and the other removes polluting material by biological means. Within these categories numerous combinations or adaptions thereof can be used to meet variant conditions of waste from a community and requirements of the receiving stream. Industrial treatment processes vary widely, often within the same general type of industry. Changes in processes, by-products recovery, salvage, improved housekeeping, and comparable practices are often very effective measures of controlling industrial pollution. Control of industrial waste may present an entirely different problem than that incurred in municipal wastes, since the wastes may contain toxic or otherwise objectionable substances not amenable to either sedimentation or biological treatment. However, the objective of the control program remains the same--protection of waters by reduction of objectionable substances to within tolerance levels compatible with water uses. The water pollution control programs in the Yellowstone Basin are based on these premises.

While sewage and waste treatment processes cannot be controlled precisely, they can be regulated between rather well established limits. The effective removal of solids from domestic wastes by sedimentation is termed primary treatment and is generally considered to reduce Biochemical Oxygen Demand* from 25 to 40 percent. The removal of Biochemical Oxygen Demand by biological methods is termed secondary treatment. A plant incorporating effective primary and secondary treatment is generally considered capable of removing from 75 to 85 percent of the organic polluting material. Greater reduction, sometimes referred to as tertiary treatment, can be obtained by repetitive passages of wastes through the treatment processes or by increasing the number of combinations of treatment processes. Sewage and waste treatment methods thus defined apply only to organic materials that can be decomposed by biological action or those that may be removed by sedimentation. Inorganic waste such as most acids, alkalies, and metallic ions, must be controlled by recovery, neutralization, storage, evaporation or other specialized processes.

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[1]Merriman and Wiggins, American Civil Engineers Handbook, page 1750--Legal and Economic Features of Water Rights, 5th Edition.

*Biochemical Oxygen Demand is the quantity of oxygen utilized by microorganisms under aerobic conditions while feeding on and stabilizing organic materials under specified conditions of time and temperature.

The water pollution control agencies in the Yellowstone Basin have endorsed the following:

(1) Toxic substances including metallic ions, phenol compounds, oils, and acids must be virtually eliminated from streams. Such substances are inimical to aquatic life and if present in sufficient concentrations are hazardous to human life and to livestock.

(2) Removal of settleable and floating solids to prevent sludge banks, floating materials, and nuisance conditions should be required as the minimum acceptable treatment. Property values, recreation, fishing, stock watering, and other water uses are thus provided a measure of protection.

(3) Treatment required beyond effective primary treatment is influenced by downstream water uses and by the amount of dilution water available during periods of low flow. Biological removal of dissolved organic materials and bacteria must be provided where necessary to: (a) maintain dissolved oxygen at levels necessary for balanced aquatic life; (b) maintain desirable water quality for domestic, industrial, or recreational uses; and (c) prevent nuisance and health hazards.

(4) For industrial wastes similar in nature to municipal wastes, treatment should be based on the same premises as that recommended for municipalities. For industrial wastes not similar to municipal wastes, treatment should be provided as necessary to prevent substantial deterioration of water quality in the receiving stream.

The future water pollution control program in the Yellowstone River Basin should include:

(1) Enactment of comprehensive pollution control legislation in Montana.

(2) Construction of treatment plants where none now exist, and improvement of existing plants where they are presently inadequate to meet needs.

(3) Dissemination of information concerning the effects of pollution on public health, fishing, irrigation, livestock watering, waterfowl production, industrial water supply, recreation, and other water uses.

(4) Better operation and improved maintenance of existing treatment works.

(5) Periodic surveillance of stream conditions to supplement sewage treatment plant inspections so that needs for improved treatment can be seen well in advance of actual necessity, thus enabling planning and construction to be carried forward with a minimum of delay.

(6) Minimizing the adverse effects of mine wastes in streams through a program of adequate mine waste controls.

Action toward the achievement of the comprehensive stream control program in Montana, North Dakota, and Wyoming, has begun under the direction of the State health agencies. Progress will be largely determined by the ability of these agencies to secure the support of the citizenry of the States to provide adequate stream pollution control legislation, funds, and personnel.

The cost of adequate sewage treatment facilities, including original construction cost, operation, and maintenance, has been estimated to be between $9 and $15 per year per family, depending upon the size of the community and degree of treatment required. Costs per family are usually lowered as the size of the community increases. The cost of constructing adequate treatment facilities, including the 18 new municipal plants, 9 enlargements, replacements or additions to existing plants, and 12 new industrial waste treatment plants and enlargements to 6 existing industrial plants in the Yellowstone Basin, is estimated at $5,000,000. The estimate does not include the cost of new sewers to connect treatment works with existing sewer systems, nor does it reflect the cost of operation and maintenance.

Surveys of most of the sources of pollution in the Yellowstone Basin have been made by the State water pollution control agencies and reports containing findings of the investigations together with recommendations for correcting or improving conditions have been provided municipal and industrial officials and other interested parties. State reports are available for public inspection. The State water pollution control agencies have further cooperated with representatives of numerous industries and municipalities through conferences regarding specific problems of pollution, and have worked closely with engineers officially employed by the municipalities and industries to study pollution problems. These activities were inaugurated several years ago as a part of a continuing program. Municipal and consultant engineering studies, where made, substantiate treatment needs as indicated in this report.

The value of supplemental flows from proposed reservoirs as an aid in alleviating stream pollution has been recognized by the water pollution control agencies. It is of considerable importance that reservoir regulatory programs provide for releases of water to implement sewage and industrial waste treatment.

A resumé of the needs of municipalities, institutions, and industries necessary to prevent pollution of the streams of the Yellowstone Basin is presented as follows:

Yellowstone National Park

The three large tourist camps and hotels in the park are presently served by sewage treatment facilities. The physical appurtenances and operation of these plants are generally satisfactory. Since these plants discharge their effluent into the Yellowstone or Gardiner Rivers

it is highly important that their efficiency remain at high levels to protect the aesthetic and recreational value of these beautiful streams.

Gardiner, Montana

This municipality is provided with a septic tank in which the settleable materials in sewage are collected, however its efficiency of operation is very poor and the facilities are considered inadequate to protect the health of those using the waters of the Yellowstone River into which the waste from the septic tank is discharged. Tourists occasionally use the stream water for drinking purposes with little thought to the possible dangers from upstream pollution. For this reason secondary treatment, incorporating disinfection of the treated sewage, is desirable. Water is diverted below Gardiner to irrigate an extensive area adjacent to Livingston, Montana.

The Jardine Mining Company when operating is primarily responsible for the inorganic pollution of Bear Creek. The storage of mill tailings from this operation is being attempted. Previously this and similar operations have been deleterious to fish life.

Livingston, Montana

The City of Livingston discharges untreated sewage and the Northern Pacific Railroad discharges oil wastes from its maintenance shops into the Yellowstone River. The river above Livingston is a relatively clean stream except for sporadic releases of wastes from mining operations. Its scenic and fishery values are great throughout this reach. Water is also diverted for irrigation immediately below the city. The protection of these very valuable water uses is therefore necessary and should be provided through adequate waste recovery or treatment processes. Secondary treatment is recommended.

Big Timber, Montana

The sewage from this municipality is discharged through a septic tank into the Yellowstone River. Secondary treatment is recommended. The City of Columbus, located about 40 miles below Big Timber, obtains a portion of its water supply from the river.

Columbus, Montana

Treatment is provided for the liquid wastes of Columbus prior to their discharge into the Yellowstone River. Present treatment works are considered satisfactory to protect downstream water uses. The reach of the Yellowstone River below Columbus is highly scenic and public use is great. Stream water is also used extensively for irrigation purposes.

Laurel, Montana

This municipality has recently placed a new primary sewage treatment plant in operation in response to an order issued by the Montana State Board of Health. An evaluation of the treatment has not yet been made. Industrial wastes from the Farmers Union Co-Op Refinery

and the Northern Pacific Railroad continue to reach the river. Proper control of these latter wastes is necessary to protect the Billings water supply and fishery values in the river. The Montana Fish and Game Department indicates that a 55 mile stream reach below Laurel has little value because of petroleum taste imparted to fish from oil waste.

Bear Creek, Montana

The Village of Bear Creek has primary treatment and discharges its treated waste into Bear Creek, thence to Clarks Fork River. The limited data now available indicate this plant is satisfactory.

Bridger, Montana

The settleable material is removed from the sewage of Bridger prior to its discharge into the Clarks Fork River. While treatment is necessary at Bridger to protect the public water supply at Fromberg, Montana, located about nine miles below, the present sewage treatment plant is considered satisfactory.

Red Lodge, Montana

The City of Red Lodge provides primary treatment for the municipal wastes prior to their discharge to Rock Creek, tributary of Clarks Fork River. The present plant is considered satisfactory.

The canning plant discharges its waste into the creek after only minor treatment. The seasonal operation of the canning factory constitutes a treatment problem, however the wastes should be adequately controlled, either by withholding them from the stream or by treatment.

Billings, Montana

A new primary sewage treatment plant was placed in operation by the City of Billings during the summer of 1950 in response to orders from the Montana State Board of Health. A complete evaluation of the plant has not yet been made. However, because private water supplies are derived from irrigation diversions downstream, chlorination of the effluent of the treatment plant has been recommended by the State Board of Health.

Industrial wastes, including that from the Great Western Sugar Refinery and the canning factory, are not at present receiving treatment. Discharged materials should be salvaged or adequately treated. The protection of the river for public water supplies has highest priority of water uses. The domestic water supply for the farm population residing on the large irrigation projects below Billings is derived from water taken directly from the Yellowstone River. While the before-mentioned industrial wastes may contain relatively few dangerous bacteria they greatly increase the organic content of the water and induce tastes and odors which may make the water unpalatable.

Lander, Wyoming

This municipality located far up on the headwater tributary of the

Big Horn River discharges untreated sewage into the Middle Popo Agie River. Extensive diversion of these waters for irrigation below Lander makes it desirable to provide primary treatment for all wastes. The City of Thermopolis, Wyoming, located about 100 miles below Lander, derives its water supply via infiltration gallery from the Big Horn River. In the near future the Boysen Reservoir will impound the waters of the Big Horn River between Lander and Thermopolis. This undoubtedly will reduce dangers to the water supply at Thermopolis, but it may produce an equally undesirable situation with respect to the use of Boysen Reservoir for recreational purposes.

Shoshone Indian Reservation Headquarters, Fort Washakie, Wyoming

Sewage from the Indian Agency Headquarters is provided a high degree of treatment. Present facilities are adequate.

Riverton, Wyoming

Untreated sewage is discharged in the Big Horn River at Riverton. The installation of primary treatment at Riverton is recommended as a measure of protection for downstream irrigation and recreation interests.

Thermopolis, Wyoming

The City of Thermopolis has completed plans and voted bonds for installation of a sewage treatment plant. Plans have also culminated for construction of a new sewage treatment plant at Hot Springs State Park near Thermopolis. Industrial wastes consisting principally of cooling water from the Empire State Oil Refinery are also discharged into the Big Horn River at Thermopolis. Treatment of sewage and reduction of industrial wastes is necessary to protect the public water supply taken from the river at Worland and intervening irrigation waters.

The removal of a large portion of the silt from the Big Horn River by Boysen Reservoir has greatly increased the clarity of the stream and enhanced its fishery potential. Sewage and waste treatment at Thermopolis and Hot Springs State Park are urgently needed if the fishing value of the Big Horn below Boysen Dam is to be realized.

Worland, Wyoming

The City of Worland also discharges untreated sewage into the Big Horn River. Primary treatment is needed to protect the downstream water supply at Basin, Wyoming, a distance of about 30 miles below Worland. The Wyoming Institute for Boys located approximately 8 miles upstream from Worland has recently constructed a new plant providing secondary treatment. Several major industries are located within a short distance of the City of Worland. The Holly Sugar Company contributes a large quantity of organic wastes during the campaign (October, November, and December). The Pure Oil Company, and the Texas Gulf Sulfur Company have plants located downstream from Worland. The wastes from the oil company and sulfur companies

are being lagooned. A small portion of the wastes from the sugar company is now being collected and stored. This practice should be extended to include all wastes. Adequate waste control is urgent if the potential value of the Big Horn's waters are to be realized.

Basin, Wyoming

The Town of Basin is presently discharging untreated sewage into the Big Horn River. A sewage treatment works with at least primary treatment is needed at Basin to provide a measure of protection to the irrigation project below Basin from inherent health hazards either through direct consumption of polluted water or from vegetables grown on lands irrigated with polluted water.

Meeteetse, Wyoming

This municipality is located near the headwaters of Greybull River, a tributary of the Big Horn. The primary treatment given the village sewage is adequate at this time.

Greybull, Wyoming

Greybull is discharging untreated sewage into the Big Horn River. A minimum of primary treatment is needed to afford some protection from pollution for downstream irrigation water users.

Cody, Wyoming

Untreated sewage from the City of Cody is discharged into the Shoshone River, a tributary of the Big Horn. Secondary treatment is considered necessary at Cody to protect industrial, public, and private water supplies taken from irrigation waters diverted from the Shoshone River below Cody. In addition to the sewage, industrial wastes from the Husky Oil Refining Company plant are reaching the stream. These wastes should be collected and disposed in a manner which will not affect the water for any of its various uses in this vicinity.

Heart Mountain Camp, U.S.B.R.

The Bureau of Reclamation installation has been provided with satisfactory treatment.

Powell, Wyoming

Untreated sewage from this community discharges into Bitter Creek, a tributary of the Shoshone River. Primary treatment is necessary to protect the water supply of Lovell, Wyoming, which is taken from the Shoshone River below the confluence of that river and Bitter Creek.

Cowley, Wyoming

The Big Horn Canning Company discharges waste during its seasonal operation. Plant production data indicate that waste equivalent to organic material from 4,000 people is being discharged. Minor

treatment is now employed. Adequate control, either by withholding the material from the stream or by properly treating it, is recommended.

Lovell, Wyoming

The City of Lovell discharges untreated sewage into the Shoshone River. Primary treatment is necessary at Lovell to protect the residents of irrigation projects utilizing water below Lovell. The Great Western Sugar Company operates a refinery at Lovell. The wastes from this plant during the seasonal operation contribute wastes equivalent organically to an estimated 200,000 persons. The wastes should be stored for by-products recovery, evaporation or for controlled discharge so that effects on the river are minimized. With completion of Yellowtail Reservoir the need for sewage and industrial waste treatment at Lovell will be imperative.

Hardin, Montana

The domestic wastes from the City of Hardin are treated in a septic tank. Treatment given the waste is considered sufficient at the present time. The City of Hardin, however, is experiencing a rapid population growth. A thorough review of sanitary needs of the city may be necessary in the very near future. The Holly Sugar Company operates a refinery near Hardin. A strong and voluminous organic waste equivalent to that from an estimated 200,000 people is discharged into the Big Horn River during the plant's seasonal operation. Here, as at the other sugar refineries, the stronger wastes should be stored for by-products recovery, evaporation, or controlled discharge so that effects on the river are minimized.

Lodge Grass, Montana

Untreated sanitary sewage is discharged into the Little Big Horn River. Treatment consistent with water quality needed in downstream irrigation projects should be provided. These uses include water for domestic use for farms as well as for irrigation. Secondary treatment is recommended.

Crow Indian Agency, Montana

Sewage from the 800 people residing at the Indian Agency is subjected to primary treatment before being discharged into the Little Big Horn River. Treatment provided is unsatisfactory and plans for a secondary sewage treatment plant are being prepared.

Hysnam, Montana

The Town of Hysham is presently treating its sewage in a septic tank and then discharging the effluent to the Yellowstone River. The city water supply is taken from wells adjacent to the river immediately below the sewer outfall. Improved treatment is needed to protect the municipal water supply and to alleviate local nuisance conditions. Primary treatment is recommended.

Forsyth, Montana

The sewage from this municipality is given primary treatment and discharged into the Yellowstone River. The present plant is well operated, however the volume of waste being treated indicates that the plant should be enlarged, particularly as the public water supply is taken from the river at Miles City, a distance of approximately 50 miles downstream.

Lame Deer, Montana

The Indian Agency at Lame Deer has provided a septic tank to treat its sewage. The effluent is discharged into Deer Creek, a small tributary of Rosebud Creek which joins the Yellowstone River just below Forsyth. Conditions in the stream are considered satisfactory.

Fort Keough, Montana

The Montana State Agriculture Experiment Station is located at Fort Keough. Sanitary sewage from 75 employees of the station is discharged untreated into the Yellowstone River about two miles above the Miles City public water supply intake. Secondary treatment, including chlorination, should be provided for the protection of the downstream public water supply.

Miles City, Montana

Sanitary sewage from Miles City is discharged untreated into the Yellowstone River. Oil from the Chicago, Milwaukee, St. Paul and Pacific railroad shops also reaches the river through a separate sewer line. Primary treatment and chlorination is recommended at Miles City to control pollution from the domestic sewage. Oil separators should be installed at the railroad shops to intercept the oil wastes. These measures are considered necessary in order to protect domestic water supply secured from irrigation ditches carrying Yellowstone River water in projects downstream from Miles City.

Ranchester, Wyoming

The sewage treatment works at Ranchester, consisting of a septic tank and a leaching bed, are considered adequate for the present.

Sheridan, Wyoming

The activated sludge plant at Sheridan was designed to provide a high degree of treatment prior to discharge of sewage into Goose Creek, a tributary of the Tongue River. The present treatment facilities, however, have become overloaded and should be enlarged to accommodate the increasing flow of sewage. Since the plant has become overloaded the receiving stream has been damaged for fishing. Also irrigation waters need the additional protection that would be given by a more efficient treatment works. There are two other sources of sanitary sewage near Sheridan, the State Home for Girls, and the Veterans' Administration Hospital. A secondary treatment plant is under

construction at the State Home for Girls, and the Veterans' Administration Hospital has recently installed a secondary treatment plant.

Birney, Montana

The Indian School at Birney has installed a septic tank whose effluent is discharged into the Tongue River. Facilities are considered adequate for present usage.

Midwest, Wyoming

The settleable material is removed from the sanitary sewage of Midwest prior to its discharge into Salt Creek, a tributary of the Powder River. Present treatment facilities are adequate for the population served, however this represents less than one-half of the community's inhabitants.

Buffalo, Wyoming

Pollution from the sewage of Buffalo has devaluated the waters of Clear Creek for fishing and livestock watering. The enlargement of the existing secondary plant is considered necessary.

The State Old Soldiers' Home at Buffalo recently completed construction of a new sewage treatment plant providing secondary treatment.

Broadus, Montana

Sewage from Broadus is discharged untreated into the Powder River. The development of proposed irrigation along the lower Powder River will make more urgent the need of sewage treatment at this location. The State Board of Health has recommended primary treatment.

Terry, Montana

A portion of the settleable material from the sewage of Terry is removed in a septic tank prior to its discharge into the Yellowstone River. Present treatment facilities are considered adequate.

Baker, Montana

Replacement of the existing sewage treatment plant at Baker has been recommended by the Montana State Board of Health. Present treatment works are obsolete. Pollution in Sandstone Creek has reportedly damaged the stream for livestock watering. A court case is pending against the City in regard to alleged nuisance conditions in the creek as a result of inadequate sewage treatment. Secondary treatment is recommended.

Glendive, Montana

The City of Glendive discharges untreated sewage into the Yellowstone River. The use of the river water immediately below the city for irrigation and for private water supplies indicates that at least

primary treatment is needed at Glendive. Property owners in the vicinity of the outfall sewers have complained about odors and unsightliness of sludge banks formed in the river when the water is low.

The Northern Pacific Railroad maintenance shops at Glendive discharge oily wastes to the river. These wastes should receive treatment to remove the oil.

Sidney, Montana

Untreated sewage from this municipality is discharged into the Yellowstone River. In addition to city sewage, large quantities of waste, estimated to be organically equivalent to that from 200,000 people are discharged from the Holly Sugar Company refinery into the river during the campaign. Present and proposed irrigation below Sidney should be protected from excessive pollution by a minimum of primary treatment. The sugar beet waste should be stored for by-products recovery, evaporation, or controlled discharge to minimize its effect on the receiving stream.

Fairview, Montana

The Town of Fairview discharges partially treated sewage from a primary treatment plant to a ditch which is tributary to the Yellowstone River. Fairview is located in Montana but the treatment facilities are in North Dakota. The plant is operating satisfactorily at the present time.

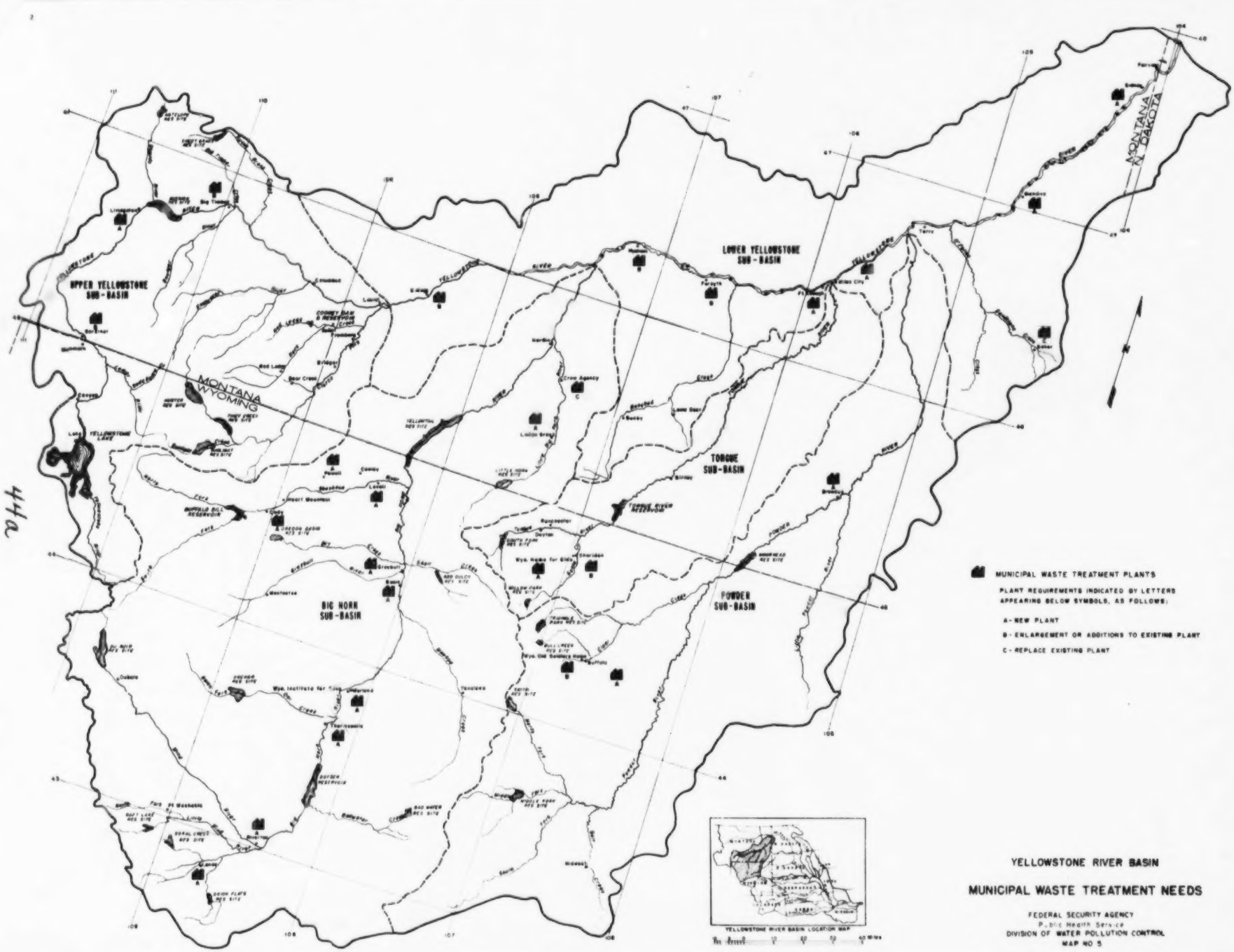
Table 13. Yellowstone River Basin. Needs for municipal and industrial waste treatment plants

Needs	Municipal		Industrial
	Number	Population served by facilities	Number
New plant	18	52,400	12*
Enlargement or additions to existing plant	7	22,400	6
Replace existing plant	2	2,400	0
No project required	21	49,000	5
Undetermined	0	0	0

*Includes 4 industries where a minor degree of treatment has been applied previously.

Table 14. Yellowstone River Basin. Current status of municipal and industrial action on pollution abatement needs

Status of project	Number of Municipalities	Number of industries
Inactive	23	18
Abatement ordered	0	0
Final plans approved	2	0
Construction awaiting financing	0	0
Under construction	1	0
Status undetermined	0	0
Planning initiated	1	0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LOWER YELLOWSTONE SUB-BASIN
TONGUE SUB-BASIN
BIG HORN SUB-BASIN
POWDER SUB-BASIN
MONTANA WYOMING
MONTANA N. DAKOTA
MUNICIPAL WASTE TREATMENT PLANTS
PLANT REQUIREMENTS INDICATED BY LETTERS APPEARING BELOW SYMBOLS, AS FOLLOWS:
A - NEW PLANT
B - ENLARGEMENT OR ADDITIONS TO EXISTING PLANT
C - REPLACE EXISTING PLANT
YELLOWSTONE RIVER BASIN LOCATION MAP

YELLOWSTONE RIVER BASIN

MUNICIPAL WASTE TREATMENT NEEDS

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO 5

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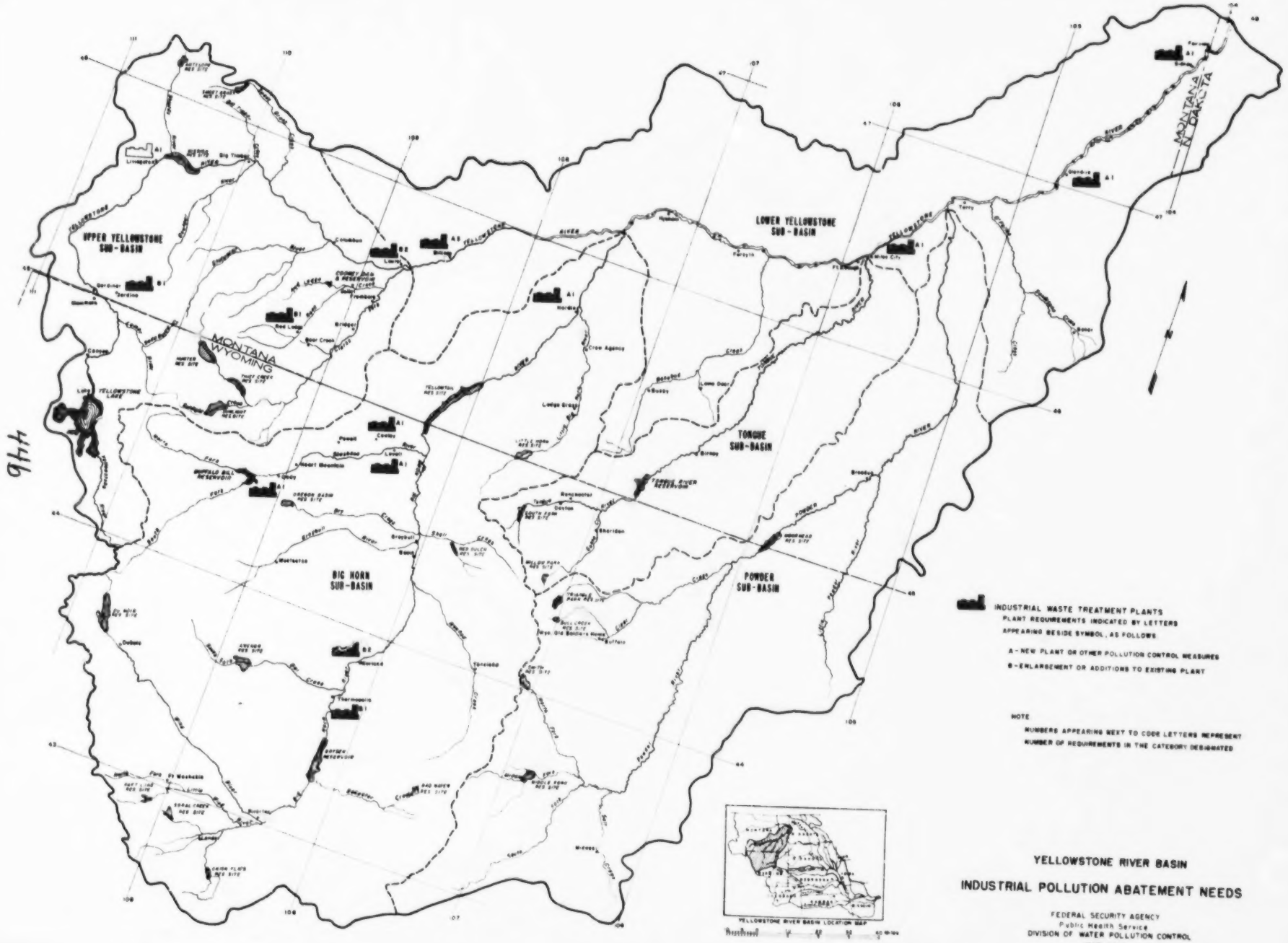
UPPER YELLOWSTONE SUB-BASIN
LOWER YELLOWSTONE SUB-BASIN
TONGUE SUB-BASIN
BIG HORN SUB-BASIN
POWDER SUB-BASIN
MONTANA WYOMING
MONTANA N. DAKOTA
INDUSTRIAL WASTE TREATMENT PLANTS
PLANT REQUIREMENTS INDICATED BY LETTERS APPEARING BESIDE SYMBOL, AS FOLLOWS
A - NEW PLANT OR OTHER POLLUTION CONTROL MEASURES
B - ENLARGEMENT OR ADDITIONS TO EXISTING PLANT
NOTE
NUMBERS APPEARING NEXT TO CODE LETTERS REPRESENT NUMBER OF REQUIREMENTS IN THE CATEGORY DESIGNATED
YELLOWSTONE RIVER BASIN LOCATION MAP

YELLOWSTONE RIVER BASIN

INDUSTRIAL POLLUTION ABATEMENT NEEDS

FEDERAL SECURITY AGENCY
Public Health Service
DIVISION OF WATER POLLUTION CONTROL
MAP NO. 6

APPENDIX

MONTANA WATER POLLUTION CONTROL LEGISLATION

I. General Statement

The State Board of Health has "general oversight and care" of all waters used as sources of water supply for domestic purposes; and of all waters "with respect to their condition and use as affecting the public health."

At its 1949 session, the legislature adopted the Council of State Governments' draft Water Pollution Control Enabling Act (Ch. 184, Laws 1949). Other statutes relating to water pollution control are collected in Ch. 13, Tit. 69, Rev. Codes, 1947. Statutes relating to the organization of the State Board of Health and its general powers and duties are collected in Ch. 1, Tit. 69, Rev. Codes, 1947, as amended by Ch. 57, Laws 1949. Apart from these laws, which are directed to the control of pollution in waters used for domestic purposes, criminal statutes make it unlawful to put dead animals, offal, etc. in all streams, ponds, lakes, or reservoirs (Sec. 94-3542, Rev. Codes, 1947); to deposit coal slack in any stream (Sec. 94-3551, Rev. Codes, 1947); and to poison any well, spring, or reservoir (Sec. 94-35-255, Rev. Codes, 1947).

The State Board of Health has been designated by the Surgeon General as the water pollution control agency for the State.

II. Administrative organization

The State Board of Health consists of seven members (Sec. 69-102, Rev. Codes, 1947, as amended by Sec. 2, Ch. 57, Laws 1949).

The Board's jurisdiction in the area of water pollution control is Statewide.

There is an office of executive director within the Board, and the person holding that office is the administrative and executive head of the Board. Each division and section of the Board is responsible to the executive officer (Sec. 69-103, Rev. Codes, 1947, as amended by Sec. 3, Ch. 57, Laws 1949). Water pollution control activities are centered in a division of sanitary engineering, apparently created by administrative action.

The executive officer appoints all subordinate personnel with the consent of the Board, subject to provisions of the merit system (Sec. 69-103, Rev. Codes, 1947, as amended by Sec. 3, Ch. 57, Laws 1949). There are no specific provisions for delegations of authority.

There is no advisory council.

III. Powers and duties

1. Development of comprehensive program.

The Montana laws do not specifically provide for the development of a comprehensive program, nor for the setting of standards of water purity, nor for classifying waters. The Board of Health's authority, however, is broad. It is given "general oversight and care of all inland waters, streams, lakes, and ponds used as sources of water supply" (Sec. 69-1301, Rev. Codes, 1947); it may "cause examination of waters to be made to ascertain their purity and fitness for domestic use, or their liability to impair the interests of the public, or of persons lawfully using them, or to imperil the public health" (Sec. 69-1302, Rev. Codes, 1947); it may make rules and regulations to prevent pollution and "to secure the sanitary protection of all waters as are used for domestic purposes" (Sec. 69-1302, Rev. Codes, 1947); it shall make and publish in a monthly bulletin "rules and regulations for the collection of samples and analyses of water, either natural or treated" (Sec. 69-1304, Rev. Codes, 1947).

2. Issuance of permits and review of plans and specifications.

"Cities, towns, and all other corporations, companies, or persons shall submit to said Board, for its advice and approval, their proposed system of water supply, or of the disposal of drainage or sewage, and no city, town, or person or company shall proceed to build or install or enlarge or extend any system of water supply, drainage, or sewage disposal, without first obtaining the approval of the State Board of Health" (Sec. 69-1308, Rev. Codes, 1947; see also Sec. 69-125, Rev. Codes, 1947).

Municipal and private corporations and persons intending to construct any railroad, logging road, logging plant, electric plant, or manufacturing plant upon the watershed of any public water supply system must first furnish the State Board of Health with detailed plans and specifications of the sanitary precautions to be taken which must be approved by the Board (Sec. 69-1310, Rev. Codes, 1947).

Anyone drilling a water well intended for use by the public shall furnish the Board of Health with such information as the Board may by rule or regulation require (Sec. 69-1311, Rev. Codes, 1947).

3. Enforcement

Upon a complaint the State Board may issue orders prohibiting the continuance of any pollution and requiring the removal of any cause of pollution (Sec. 69-1314, Rev. Codes, 1947). Presumably the Board may also issue orders on its own motion.

Administrative hearing is not required prior to issuance of the Board's orders. Miles City v. State Board of Health, 102 Pac. 696.

Persons aggrieved by any order of the Board may appeal to the district court (Sec. 69-1316, Rev. Codes, 1947). In the case of an appeal by a city or town, the statute is express that the case shall be tried de novo (Sec. 69-125, Rev. Codes, 1947).

Upon application of the State Board of Health or of any person interested, the district court of any county has jurisdiction in equity to enforce the Board's orders, rules and regulations (Sec. 69-1317, Rev. Codes, 1947). The Board has general authority to bring actions in the courts for the enforcement of the public health laws and the Attorney General is required to bring all suits and actions ordered by the Board (Secs. 4 and 6, Ch. 57, Laws 1949).

Violation of any provision of the act or of any rule, regulation or order of the State Board of Health is punishable by fine or imprisonment (Sec. 69-1320, Rev. Codes, 1947).

4. Conduct of studies, investigations, and research.

The Board of Health is authorized to establish and maintain an experiment station for the purpose of studying the best methods of preventing pollution, for the purification of water, and for the purification, disinfection, and disposal of sewage and domestic and manufacturing waste (Sec. 69-1318, Rev. Codes, 1947).

5. Cooperation with other public and private agencies.

Under the Council of State Government's draft enabling act passed by the last legislature, the State Board of Health has authority to take any action necessary to secure to the State the benefits of the Federal Water Pollution Control Act, to cooperate with other agencies and to enter into agreements with other States (Ch. 184, Laws 1949).

6. Administrative powers.

Under its general powers the State Board of Health has authority to hold hearings, administer oaths, subpoena witnesses, and to take testimony in all matters relating to the exercise and performance of its powers and duties (Sec. 4, Ch. 57, Laws 1949).

The Board has investigatory and visitorial powers (Secs. 69-1301, 69-1302, 69-1304, 69-1308, 69-1314, 69-1315, Rev. Codes, 1947).

No special procedures are provided in relation to the making of orders, granting of permits, the issuance of rules and regulations. Requirements respecting publication of orders, rules and regulations are contained in Sec. 69-1303, Rev. Codes, 1947.

IV. Exemption from operation of act

There are no exemptions specified.

V. Preservation of existing rights and remedies

None.

VI. Statement of policy, severability clause

No general statement of policy is set forth in the laws. The enabling act contains a severability clause (Ch. 184, Laws 1949).

VII. Interstate agencies

The State is not a member of an interstate agency.

REVIEW OF NORTH DAKOTA WATER POLLUTION LAWS

Summary

North Dakota has no comprehensive water pollution control legislation. The authority that exists is placed in the Water Conservation Commission, the State Department of Health, local boards of health under the supervision of the State Department, the Industrial Commission, and water conservation districts. Since no State agency has comprehensive authority in the water pollution control field, the State Department of Health has been designated as the State water pollution agency pursuant to the Federal Water Pollution Control Act.

The State Health Department has been active in the field of water pollution control and considerable progress has been made. The principal weaknesses have been the lack of adequate statutory support and insufficient personnel. Both of these deficiencies should be corrected.

Administrative Organization

Water Conservation Commission. The Commission, a public corporation, was established in 1937 (Laws 1937, c. 255) for water conservation, flood control, and the abatement of stream pollution. Its membership consists of the Governor, who is the chairman, and of four other members appointed by him. The Commission may appoint assistants and fix their compensation. R.C. 1943, 61-0201 to 61-0213.

State Department of Health. The State Department of Health consists of the Health Council, the State Health Officer, the directors of divisions, and other employees of the Department.

The Health Council is composed of nine members appointed by the Governor. The members are representatives of various interested professions and groups and of the public.

The executive officer of the Department is the State Health Officer who is appointed by the Governor. He must be a physician who has special training or experience in public health administration.

The Department has certain named divisions, including a Division of Sanitary Engineering. Other divisions may be added by the Council. The State Health Officer appoints and prescribes the duties of the division directors. R. C., 1947 Supp., c. 2301.

Powers and Duties

Development of Comprehensive Programs. There is no express statutory authority to develop a comprehensive program, to set standards of water purity, or to classify waters.

Issuance of Permits and Review of Plans and Specifications. No sewage disposal plant may be constructed without the prior approval of the Commission and of the Department of Health. R. C., 1943, 61-0221.

Enforcement. There is no express authority to hold hearings or to issue orders. Every person who wilfully violates or refuses or omits to comply with any lawful order, direction, prohibition, or regulation of a board of health or of a health officer is guilty of a misdemeanor and shall be punished by imprisonment for not more than 30 days or by a fine of not more than $1,000, or both. R. C., 1943, 23-0512.

Every person who throws or deposits any gas tar or refuse of any gas house or factory into any public water or into any sewer or stream emptying into public water is guilty of a misdemeanor, R. C., 1943, 61-0112.

The following acts are also misdemeanors punishable by a fine of not more than $100:

(1) The placing of dead animals, refuse, privies or privy vaults upon the banks or in the water of any lake or stream within the jurisdiction of the State;

(2) The placing of any structure or corral within which horses, cattle, swine, or sheep are kept within 60 feet of the top of the bank of a stream or lake;

(3) The placing of a slaughterhouse or grave within 80 feet of a lake or stream. R. C., 1943, 61-0113 and 61-0114.

Any person who places sawdust or other refuse in water in which fish abound, or in which the State or Federal Government has placed or may place fish or fish eggs is guilty of a misdemeanor and shall be punished by a fine of not more than $100 or by imprisonment of not more than 30 days, or both. R. C., 1943, 20-0124 and 20-0612.

To deposit liquid waste from a rendering plant upon the surface of the ground, or to dispose of it in a manner which makes any water supply unfit for human or livestock use is a misdemeanor punishable by a fine of not more than $100 or by imprisonment of not more than 90 days, or both. R. C., 1943, 36-0705 and 36-0714.

Conduct of Studies, Investigations, and Research. The Water Conservation Commission has power to investigate and plan all works, dams, and projects "to provide sufficient water flow for the abatement of stream pollution." R. C. 1947 Supp., 61-0214f.

The Commission may investigate, plan, and cooperate with other States, the Federal Government, and the Dominion of Canada for the purpose of preventing water pollution. R. C. 1943, 61-0224.

The duties of the State Health Officer include the duty to "study health problems and plan for their solution as may be necessary." R. C. 1947 Supp., 23-0105(4). The Director of the Division of Public Health laboratories of the Department shall, among other things "Cause sanitary statistics to be collected and tabulated, and cause to be ascertained by research work such methods as will lead to the improvement of the sanitation of the various parts of the state;" R. C. 1943, 23-0109(4).

Cooperation with Other Public and Private Agencies. The Water Conservation Commission is authorized to investigate, plan, cooperate, and make all contracts or compacts with the United States, Canada, or any State for the purpose of preventing water pollution. The Commission may also accept and use any funds from the United States for such purpose. R. C. 1943, 61-0224.

Any State officer, department, or board which is authorized to deal with the United States or any State concerning water pollution must, before any action is taken, obtain the approval of the Commission. R. C. 1943, 61-0225.

For the purpose of obtaining financial aid from the United States, the Commission may adjust the plans and operation of any project to conform to the laws and regulations of the Federal Government. R. C. 1943, 61-0239.

The Department of Health is authorized to accept Federal funds for "public health work." R. C. 1947 Supp., 23-0111.

Municipalities are authorized "to accept aid from, cooperate and contract with, and to comply with and meet the requirements of any Federal or State agency for the establishment, construction and maintenance of public works...for the prevention of stream pollution or for sewage disposal..." R. C. 1947 Supp., 40-0501(59).

Administrative Powers. The statutes provide that all water within the State belong to the public. R. C. 1943, 61-0101. R. C. 1943, 61-0229, provides that the Water Conservation Commission "shall have full control over all unappropriated public waters of the State, whether above or under the ground, to the extent necessary to fulfill the purposes of this chapter." R. C. 1947 Supp., 61-0214, provides that the Commission "shall have full and complete power, authority, and general jurisdiction:..."

"1. To investigate, plan, regulate, undertake, construct, establish, maintain, control, and supervise all works, dams, and projects, public and private, which in its judgment may be necessary or advisable:

. . . . . .

f. To provide sufficient water flow for the abatement of stream pollution;

"2. To define, declare, and establish rules and regulations:

. . . . . .

c. For the complete supervision and control of acts tending to pollute watercourses, for the protection of the health and safety of all the people of the state;

"3. To exercise full power and control of the construction, operation, and maintenance of works and the collection of rates, charges, and revenues realized therefrom;

. . . . . .

"5. To exercise all express and implied rights, power and authority, that may be necessary, and to do, perform, and carry out all of the expressed purposes of this chapter and all of the purposes reasonably implied incidentally thereto or lawfully connected therewith."

The powers granted the Commission do not limit or deprive the Department of Health of its jurisdiction to prevent water pollution. The Commission may not declare water polluted without a finding to that effect by the Department. R. C. 1943, 61-0215.

Although, as indicated above, the statutes do not expressly authorize the Commission to hold hearings or to order persons to cease polluting water, such authority would seem to be reasonably implied from the foregoing statutory provisions.

Statutes enacted prior to 1895 authorized municipalities to empty untreated sewage into streams. R. C. 1943, 40-2204. See also R. C. 1943, 20-0612 (enacted in 1909) and 61-0114 (enacted prior to 1895), which recognize this authority. Although these statutes have never been expressly repealed, it may be that the later statutes which established the Commission and granted it water pollution control powers modified them by implication.

R. C. 1947, Supp., 23-0103, provides that the Health Council shall: "Establish standards, rules, and regulations which are found necessary for the maintenance of public health, including sanitation and disease control."

R. C. 1947 Supp., 23-0104 provides: "All rules and regulations promulgated by the health council under the powers granted by any provisions of this Act (title) shall be binding upon all county and municipal health officers, ... and shall have the force and effect of law."

The State Health Officer is required to enforce all rules and regulations of the Council and to hold local boards of health responsible for the enforcement of State regulations. R. C. 1947 Supp., 23-0105.

The county superintendents of public health are required, under the supervisory control of the Department of Health, to investigate public water and ice supplies which are suspected of being infected and to cause them to be condemned when necessary. R. C. 1943, 23-0307.

The county boards of health are authorized, under the supervisory control of the Department of Health, to supervise public water supplies and sewerage systems outside the corporate limits of any city. R. C. 1943, 23-0502.

City health officers are required to enforce the rules and regulations of the State Department of Health and of the city boards of health, the health ordinances of the cities and the health laws of the State. R. C. 1943, 23-0405 and 23-0407.

Water conservation and flood control districts may be organized on the approval of the Water Conservation Commission. The Board of Commissioners of such a district is authorized to make rules and regulations to prevent the pollution of water within the district. Laws 1949, c. 348, sec. 8.

The Industrial Commission is authorized to make rules and regulations which require oil and gas wells to be drilled, cased and plugged in such a manner that pollution of fresh water supplies will be prevented. The regulations may also require that a report of the plugging be made to the State Geologist within 60 days after completion of a well. R. C. 1943, 38-0804.

Exemptions from Operation of Act

The only exemption from the water pollution control statutes is found in R. C. 1943, 20-0612, 40-2204, and 61-0114, supra, which may authorize municipalities to empty untreated sewage into streams.

Preservation of Existing Rights and Remedies

Laws 1937, c. 255, which created the Water Conservation Commission and granted it water pollution control powers provided in section 20 that nothing contained in the act should "repeal, amend, or modify any existing Acts or statutes pertaining to the appropriation or use of water except as herein otherwise provided. . ." A similar provision was contained in the re-enactment of 1939. Laws of 1939, c. 256, section 20.

As indicated above, R. C. 1943, 61-0215, provides that nothing in the act deprives the Department of Health of its jurisdiction to prevent water pollution.

Statement of Policy

R. C. 1943, 61-0201, provides that the general welfare and health of all the people require that the regulation and prevention of water pollution necessitates the exercise of the sovereign powers of the State and that such regulation and prevention are affected with a public purpose; that the Water Conservation Commission in the exercise of its powers and in the performance of its duties shall be considered to be performing a governmental function for the benefit, welfare, and prosperity of all the people of the State.

Laws of 1937, c. 255, and Laws of 1939, c. 256, stated in sections 33 and 34 respectively that the provisions of the acts were severable and that if any one was unconstitutional, void, or inoperative, the others should remain in full force and effect.

Interstate Agencies

North Dakota participates in the following interstate agencies:

(1) The Missouri Basin Public Health Council, which includes the States within the area of the Missouri Drainage Basin Office. The other States are Nebraska, Montana, South Dakota, Wyoming, Minnesota, Colorado, Kansas and Missouri.

(2) Tri-State Waters Commission. The Commission's duties and powers include the abatement of pollution of the Red River. Minnesota and South Dakota are the other participants. R. C. 1943, c. 61-17; S.D.C., 55.4901 to 55.4905; M.S.A. 114.09 to 114.11; approved by Congress April 2, 1938, 52 Stat. 150. Although the life of the Commission has never been officially terminated, it has not functioned for several years.

(3) Inter-State Sanitary Committee. This is an informal agreement between the North Dakota, South Dakota, and Minnesota Health Departments. The Committee has materially contributed to pollution abatement of the Red River.

REVIEW OF WYOMING* WATER POLLUTION LAWS

I. General Statement

The Department of Public Health has "general oversight and care" of all waters used as sources of supply for domestic purposes and of all waters "with respect to their condition and use as affecting the public health"** (Sec. 63-201). The State Board of Health, within the Department of Public Health, has been designated by the Surgeon General as the water pollution control agency for Wyoming.

[redacted] General statutes relating to water pollution and control are contained in Articles 1 and 2, Chapter 63, of the Wyoming Compiled Statutes, as amended. Aside from these provisions the criminal statutes make it unlawful for the owner of any sawmill, reduction works, smelter, or other manufacturing or industrial works, or any other person, to deposit in any waters wherein are living fish any sawdust, chemicals, milltailings, or any other refuse or deleterious substance that might tend to destroy the fish or pollute or render the waters unfit for domestic, irrigation, stock, or any other purpose (Sec. 47-507). Section 9-220 makes it unlawful to poison any spring, well, or reservoir of water with intent to injure or kill a human being.

II. Administrative Organization

The Department of Public Health consists of two divisions: The State Board of Health and the Division of Administration (Sec. 63-144). Specific and direct authority over water pollution control rests in the Division of Administration (Sec. 63-149). The Board of Health acts in an advisory capacity to the State Director, who is the administrative and executive head of the Division of Administration (Sec. 63-147(1)). The Board also has authority to determine general policies to be followed by the Division of Administration in administering public health laws (Sec. 63-147(2)).

The Department of Public Health's jurisdiction in the area of water pollution control is Statewide.

Water pollution control activities of the Department of Public Health are centered in a Division of Public Health Engineering and Sanitation apparently established by administrative action. Employees are appointed subject to merit system provisions (Sec. 63-146). The power to provide for delegations of authority to subordinate officials is implied in Section 63-149.

A council appointed by the Governor, consisting of the Director of the State Department of Public Health, State Game and Fish Commissioner, State Engineer, State Commissioner of Agriculture, and five other members, including a representative of industry and a

*Statutory references are to Wyoming Compiled Statutes, 1945, as amended, Cum. Supp. 1949.

**Senate Bill No. 30, enacted by Wyoming Legislature February 9, 1951, provides that any pollution which adversely affects livestock, agricultural crops, wildlife, fish or aquatic life, is also deemed to affect public health.

representative of municipal government, is charged with the primary duty of advising the State Department of Public Health in developing a comprehensive program for the prevention, control and abatement of new or existing pollution of the waters of the State (section 63-201).

III. Powers and duties

1. Development of comprehensive program.

The Wyoming laws do not specifically provide for the setting of standards of water purity, nor for classifying waters. Amendments in 1947 provide for the enforcement of such sanitary standards as to quality of water and as to quality of the effluent of sewage treatment plants "as are or may be established by law" (Sec. 63-149). No such standards appear to have been established "by law." However, the Department of Public Health does have broad authority in this field. It is given "general oversight and care of all inland waters and of all streams, lakes, and ponds used" as sources of water supply (Sec. 63-201); it may "cause examination of waters to be made to ascertain their purity and fitness for domestic use or their liability to impair the health of the public or of persons lawfully using them" (Sec. 63-202, also 63-112); it may "make rules and regulations to prevent pollution and to secure the sanitary protection" of waters (Sec. 63-202); it has power to abate nuisances when necessary for the protection of the public health (Sec. 63-149); it exercises sanitary control over the use of water employed in the irrigation of vegetables (Sec. 63-149).

2. Issuance of permits and review of plans and specifications.

"Cities, towns and all other corporations or persons shall submit to . . . [the Department of Public Health] for its advice and approval their proposed system of water supply or of the disposal of drainage or sewage, and no city, town or persons or company shall proceed to build or install or enlarge or extend any system of water supply, drainage or sewage disposal without first obtaining the approval of the . . . [Department of Public Health]" (Sec. 63-204).

"No sewage, drainage, refuse or polluting matter . . . shall be discharged into any such stream, spring lake, pond . . . unless such sewage, drainage, refuse or polluting water shall have been purified, so as to render it harmless in such a manner and under such conditions and restrictions as the . . . [Department of Public Health] may direct; provided that no city or town shall be prohibited or enjoined from discharging its sewage into a river or body of water unless such sewage so pollutes the water as to be dangerous or injurious to the public health" (Sec. 63-205).

Municipal and private corporations and persons intending to construct any railroad, logging road, logging plant, electric plant, or manufacturing plant upon the watershed of any public

water supply system must first furnish the Department of Public Health with detailed plans and specifications of the sanitary precautions to be taken which must be approved by the Department (Sec. 63-206).

3. Enforcement.

Upon complaint the Department of Public Health may issue orders prohibiting the continuance of any pollution and requiring the removal of any cause of pollution (Sec. 63-207). Presumably the Department of Public Health may also issue orders on its own motion.

There are no statutory provisions for administrative hearings prior to issuance of the Department's orders.

Persons aggrieved by any order of the Department may appeal to the district court (Sec. 63-209). The statutes are silent as to whether such appeals shall be tried de novo.

Upon application of the State Department or of any person interested, the district court has jurisdiction in equity to enforce the Department's orders, rules and regulations (Sec. 63-210).

Violation of any provision of the Act or of any rule, regulation, or order of the State Department of Public Health is punishable by fine or imprisonment (Sec. 63-212).

4. Conduct of studies, investigations, and research.

The Department of Public Health has authority to make studies and investigations relating to water pollution (Secs. 63-149, 63-202, 63-211).

5. Cooperation with other public and private agencies.

There are no provisions relating specifically to action to secure to the State benefits of the Federal water pollution control act. However, Section 63-148 contains a general authorization to accept and administer Federal aid moneys allotted for public health work.

The statutes are silent with respect to agreements with agencies of other States.

6. Administrative powers.

There is general authority in the Department of Public Health to hold hearings, administer oaths, subpoena witnesses, and to take testimony in all matters relating to the exercise and performance of its powers and duties (Secs. 63-147, 63-149).

The Department has investigatory and visitorial powers (Secs. 63-149, 63-112, 63-208).

Procedures are not spelled out with relation to the making of orders, granting of permits, the issuance of rules and regulations. Requirements respecting the publication of orders, rules and regulations are contained in section 63-203.

IV. Exemptions from operation of act

There are no exemptions specified.

V. Preservation of existing rights and remedies

None.

VI. Statement of policy, severability clause

None.

VII. Interstate agencies

The State is not a member of an interstate agency.